93-394

U.S. DEPARTMENT OF ENERGY PROJECT CHARIOT: 1962 TRACER STUDY SITE ASSESSMENT AND REMEDIAL ACTION PLAN

DOE Nevada Operations Office
Las Vegas, Nevada

July 1993

YYY CHT

Department of Energy
Nevada Operations Office
P.O. Box 98518
Las Vegas, NV 89193-8518

ERD.950718.0008

JUL 15 1993

PROJECT CHARIOT: 1962 TRACER STUDY SITE ASSESSMENT AND REMEDIAL ACTION PLAN

Enclosed is the "Project Chariot: 1962 Tracer Study Site Assessment and Remedial Action Plan." A copy will be given to all of the Alaska local governmental agencies and is available for public review at the locations noted below.

Community	Site Location	Site Address
Barrow	Barrow High School	Attn: Scott Ownbey P.O. Box 8950 Barrow, AK 99723
Kivalina	City of Kivalina	Attn: Betty Swan P.O. Box 50079 Kivalina, AK 99750
Kotzebue	Chukchi Consortium Library	Attn: Janet Hadley, Director P.O. Box 297 Kotzebue, AK 99752
Point Hope	Tikigaq School	Attn: Charles Mason P.O. Box 148 - Library Point Hope, AK 99766

Also enclosed are comments and responses which were submitted in response to the draft "Project Chariot: 1962 Tracer Study Remedial Action Plan."

The U.S. Department of Energy will be available to discuss the site assessment and remedial action at a public meeting to be held in Point Hope, on July 18, 1993, at 3 p.m., 531 Natchiq Street. We look forward to seeing you there.

Joseph N. Fiore

Joseph N. Fiore, Acting Assistant Manager
for Environmental Restoration &
Waste Management

ERD:KJC

Enclosures:
As stated

Document Control No. 93-294

Environmental Restoration

Project Chariot

1962 Tracer Study Site Assessment and Remedial Action Plan Summary Document

July 1993

U.S. Department of Energy
Nevada Operations Office

This page intentionally left blank

Project Chariot History and Present Knowledge

Site History

Project Chariot Site was an experimental part of the United States Atomic Energy Commission's (AEC) Plowshare Program established to test the use of nuclear explosives for peaceful purposes. In 1958, the AEC authorized planning and studies for an experimental harbor excavation in Alaska using nuclear explosives. The primary purpose of this project was to investigate the technical problems and to begin development of a nuclear-excavation technology. At the same time, other studies were underway using nuclear explosives, including a test called Sedan, a cratering experiment carried out at the Nevada Test Site (NTS).

The AEC, with the assistance of other agencies, university researchers, and the Canadian Government, conducted pretest environmental studies in the Cape Thompson Area to allow adequate assessment of the effect of the proposed project and to assure that it could be conducted safely. The commission conducted more than 40 separate environmental investigations, mainly between 1959 and 1961. By 1962, much of the desired nuclear-excavation engineering data originally planned to be obtained in Project Chariot Site activities had become available or would be available from experiments at other sites. The AEC decided in 1962 to suspend Project Chariot Site and to end the associated environmental studies. No nuclear explosive devices were brought to the Project Chariot Site. Many of the environmental study results and site descriptions presented in this plan were published in 1966 in a book entitled *Environment Of the Cape Thompson Region, Alaska* (Wilimovsky and Wolfe, 1966).

During the course of these environmental studies, the U.S. Geological Survey (USGS), under a license granted by AEC's Division of Licensing and Regulation, carried out a five-day (August 20-25, 1962) radioactive tracer experiment on the soils at the Project Chariot Site. The purpose of this experiment was to measure overland transport of certain radioactive tracers at the site. Small quantities of radioactive tracer material and approximately 6.8 kilograms (kg) (15 pounds [lb]) of soil containing radioactive fallout from the Sedan cratering experiment in Nevada were used for the tests. These measurements were on 12 plots, which were specifically designed to represent a variety of microdrainage patterns. All 12 test plots were adjacent to the headwater forks of Snowbank Creek, about 2.6 kilometers (km) (1.6 miles [mi]) north-northwest from the base camp. The test plots ranged in size from 0.6 by 0.6 meters (m) (2 by 2 feet [ft]) to 1.5 by 2.1 m (5 by 7 ft). The following types and activities of the radioisotopes were used:

Radioisotope	**Activity** (At the time of the test)
Cesium-137 (Cs-137)	2×10^8 becquerels (6 millicuries)
Iodine-131 (I-131)	2×10^8 becquerels (5 millicuries)
Strontium-85 (Sr-85)	2×10^8 becquerels (5 millicuries)
Project Sedan fallout	4×10^8 becquerels (10 millicuries)

The experimental technique involved the following steps:

1. Each of the plots was enclosed with 2.5 by 15-centimeter (cm) (1 by 6-inch [in.]) boards that were wrapped in polyethylene sheeting, set edgewise, and buried sufficiently deep to cut off both surface flow and shallow seepage through the soil.

2. A single tracer was distributed uniformly on each plot, generally over all the plot, but only over one-third of plots 106 and 113. Two of the tracers, Cs-137 and Sr-85, had been acquired in soluble form, dissolved in hydrochloric acid. In the Denver laboratory of the USGS, the radionuclide-bearing acid solution had been buffered and diluted with Na_2CO_3, (sodium carbonate) to a pH of about 5.6 and a concentration of about 0.05 normal, and exchanged onto a local sandy soil that contained very little organic matter. The soil then had been oven dried prior to transport to the Project Chariot Site. At the site, the soil containing the radiological tracers was further mixed with a tundra soil that had been dried and screened and that had fairly large exchange capacity and high organic matter content. The twice-mixed Cs-137 tracer was applied to plots in concentrations of about 4.4×10^3 to 8.9×10^3 becquerels per square centimeter (Bq/cm^2) (0.12 to 0.24 microcuries per square centimeter [$\mu Ci/cm^2$]). Concentrations of the Sr-85 tracer were about 5.6×10^3 to 1.3×10^4 Bq/cm^2 (0.15 to 0.35 $\mu Ci/cm^2$).

   A third tracer, I-131, was handled in much the same way except that mixing with the sandy soil at Denver was accomplished by wetting and drying rather than by exchange. The second-stage mixing at the Project Chariot Site was with the same tundra soil as that used to mix the Cs and Sr tracers. The twice-mixed I-131 tracer was applied to plots 109 and 110 in concentrations of about 10×10^3 and 2×10^3 Bq/cm^2 (0.27 and 0.054 $\mu Ci/cm^2$), respectively.

The fourth and final tracer was comprised of about 6.8 kg (15 lb) of radioactively-contaminated soil collected about 1.6 km (1 mi) from ground zero of the Sedan detonation at the Nevada Test Site. This tracer was from 45 to 50 days old at the time of these experiments. It comprised diverse fission and activation products, largely attached to particles of Nevada Test Site alluvium. It was not further mixed at the Project Chariot Site. Of this fallout tracer, about 3×10^6 Bq (70 μCi) were applied to each of three plots (113, 114, and 115), resulting in concentrations from about 3.6×10^2 to 4.4×10^3 Bq/cm^2 (0.0097 to 0.12 μCi/cm^2).

3. To simulate rainfall, water was drawn from Snowbank Creek by a portable gasoline-powered pump and applied to the plots through hose and spray nozzle. The test plots were located at a distance no greater than 20 m (60 ft) from the creek. Among the 12 plots, four received one such application, four received two applications each, and two received seven applications in succession. Each application was sufficient to transiently saturate the surface soil of the plot and to generate ephemeral runoff. The amount of simulated rain was measured in several gages (50-milliliter [mℓ] beakers); the range was between 0.64 and 4.95 cm (0.25 and 1.95 in.) per application and, in total, between 3.53 and 14.7 cm (1.39 and 5.78 in.) per test. Intensity of the simulated rainfall was substantially greater than would be expected to occur naturally.

4. Samples of the generated runoff were taken in 100-mℓ polyethylene bottles for transport to the laboratory at Denver to determine radioactivity. Also, samples of soil on several plots were taken to a depth of 1 cm (0.4 in.), for determinations of bulk density and radioactivity. On the plots to which simulated rain was applied more than once, runoff was intermittent and was regenerated by each application; each generation of runoff was sampled separately. Radioactivity due to Sr-85 and I-131 was determined by appropriate counting on 2-mℓ aliquots of runoff; that due to Cs-137 or to mixed products from Sedan fallout was first counted on 2-mℓ aliquots and later recounted on the residual samples.

In addition to the overland transport tracer study, underground transport of radionuclides was appraised by a simple 18-hour percolation test in August 1962 on a hillside above Snowbank Creek (plot 62 ABJ 116). A small pit was dug through a surface layer of humus-rich soil 15 cm (5.9 in.) thick, and about 10 cm (4 in.) into underlying silt and clay. The pit was filled to within 5 cm (2 in.) of its rim with 1.4 kg (3 lb) of Sedan soil mixed into a slurry with creek water. The pit was refilled three times with additional water. The resultant percolate was sampled in a trench dug 84 cm (33 in.) downslope from the pit. Samples were taken in 100-mℓ polyethylene bottles at 15-minute intervals during the first four hours and then once after 18 hours. At the end of the test, soil samples were taken from a subsidiary trench dug from the pit to the percolate trench. This test showed the attenuation of radionuclides adsorbed or exchanged from percolating or infiltrating water.

A sediment transport experiment was conducted on a small tributary of Snowbank Creek, which was identified as test plot 117. The reach chosen was of fairly uniform slope and cross section and had a flow rate of approximately 60 liters per minute (1pm) (16 gallons per minute [gpm]). The flow rate was determined by catching the total discharge of the stream over a small waterfall in a bucket for measured lengths of time. The stream was measured off into 6-m (20-ft) reaches. After samplers were located at the 6-, 12-, and 18-m (20-, 40-, and 60-ft) stations, a slurry containing approximately 2.47 kg (5.44 lb) of Sedan soil was introduced as a single injection slug at the zero station of the test reach. Simultaneous samples of water were collected at one-minute intervals in 1-ounce (oz) polyethylene bottles at the 6-, 12-, and 18-m (20-, 40-, and 60-ft) sampling points. Fifteen minutes after introduction of the Sedan soil slurry, the stream bottom at the point of introduction was vigorously agitated to dispense any of the slurry that may have been absorbed or settled on the stream bottom. Sampling was continued until a total time of 20 minutes had elapsed from the time of the initial introduction. All samples were transported for analysis to the USGS laboratory in Denver, Colorado.

Following completion of each test plot experiment and the percolation test, the soil was removed and transported to a waste disposal area in half-filled 55-gallon drums. Four to six half-filled drums of soil were collected for disposal. The excavated soil was poured from the drums and mixed with the in-situ site soils. The rationale behind the mixing of the soils was to disguise the isotopic ratios, for security reasons. According to historical documents, this process generated approximately 45 cubic meters (m^3) (1,600 cubic feet [ft^3]) of soil, in a mound 0.46 m (1.5 ft) thick over an area of 4 square meters (m^2) (40 square feet [ft^2]). The 2.5 by 15-cm (1 by 6-in.) boards and polyethylene sheeting were also disposed with the soil. This soil was then covered with up to 2 m (4 ft) of clean soil. The average activity concentration of the radioactivity in the soil at the time of emplacement was approximately 9.6 becquerels per gram (Bq/g) (0.26 nanocuries per gram [nCi/g]).

Both I-131 and Sr-85 have half-lives of less than 70 days. Therefore, both of these isotopes have essentially decayed away, leaving only the longer half-life Cs-137 (30 years) and Sedan fallout with half-lives of 3 years or greater. The present activity concentration of radioactivity in the soil is estimated to be 1.1 Bq/g (0.03 nCi/g), with a total activity of less than 1.1×10^8 Bq (3 mCi) for the entire mound. Based on the risk assessment review performed by Oak Ridge Institute for Science and Education (ORISE), neither the current level of radioactivity or the activity present in 1962 poses a risk to human health or the environment.

In accordance with the Health Intervention Plan for Point Hope, the Alaska Division of Public Health has reviewed all available health information and generated a report titled, *Health Risk Assessment of Radioisotopes at Cape Thompson, Alaska*, November 24, 1992. This report concluded that the radioisotopes at Cape Thompson present no health risk to subsistence hunters in the area or to persons living in nearby villages. Also, the report states that radioisotopes have never presented a risk and will not present a risk if left in their present state.

On April 28, 1963, the site of the soil test was transferred to the Naval Arctic Research Laboratory (NARL). The buildings, airstrip, and the structural improvements placed at this site were used by the U.S. Navy, and additional structures were built. The NARL ceased operations at the site in 1970, and the site was transferred to the Bureau of Land Management (BLM). The site was later transferred to the U.S. Fish and Wildlife Service (USFWS) in 1980, with the exception of two individual Native Allotments. When the U.S. Army Corps of Engineers performed the initial field investigation at the site, areas of potential environmental concern were identified and included debris, structures, and waste materials. Based on these findings, the site was identified as a potential Defense Environmental Restoration Program for Formerly Used Defense Sites (DERP-FUDS). The location was verified through real estate records maintained at the U.S. Army Engineer District, Alaska. The Department of Defense (DoD) approved this site under the DERP-FUDS program on August 8, 1988. A Remedial Action contract was awarded in fiscal year (FY) 1990 for the clean up of unsafe debris and buildings, petroleum containers, and contaminated soils. The Remedial Action was performed and completed during the summer of 1992.

Recently, a researcher at the University of Alaska at Fairbanks obtained two letters under the Freedom of Information Act (FOIA), written in the early 1960s from the USGS to the AEC. These two pieces of correspondence focused on the use of radioactive isotopes at this site during the performance of the investigations associated with the AEC's Project Chariot Site during the early 1960s. The letter also addressed the isotope materials buried at the site at the conclusion of the experiment.

In response to concerns raised through the publication of this information by the news media and heightened local political interest facilitated by public concern, the Alaska Department of Environmental Conservation (ADEC) and the U.S. Army Corps of Engineers conducted a site investigation on September 10 to 14, 1992. The surface radioactivity survey indicated no readings above background levels. No visible signs of stressed vegetation were observed. A hole was power-augured diagonally into the southwest surface of the mound. Readings were not distinguishable above background until a depth of approximately 1.1 m (3.5 ft), where a reading of 0.1 milliroentgens per hour (mR/hr) was recorded. However, based on a U.S. Department of Energy (DOE) review of the video tape of the measurements, the results should only be used for qualitative information, due to the sampling methodology employed.

On October 21, 1992, representatives from the DOE Nevada Operations Office (DOE/NV), IT Corporation, ADEC, and Point Hope and Barrow residents performed a site inspection. The objectives of the site inspection were to assess the soil disposal mound; to perform a radiation survey of the mound surface; to inspect and access logistically important facilities at the site (airfields); and to inspect the buildings at the site for potential use. No readings were registered above background at the surface of the soil disposal mound using a gamma scintillation counter, an alpha scintillation probe, and a beta/gamma Geiger-Mueller pancake probe.

Based upon all available information, the DOE's position is that the disposal mound has never nor will it ever present a hazard to the public or the environment. Upon evaluation of potential costs for further investigations at the site and complicated logistic issues, the DOE determined that the implementation of a remedial action was the most cost-effective approach.

U.S. Department of Energy Environmental Restoration Program

In 1990, the DOE/NV initiated an Environmental Restoration Program as part of an overall national program. This program is investigating and addressing environmental issues at all locations where nuclear weapons testing has been conducted by the United States government including test sites in Nevada, Mississippi, Colorado, New Mexico, Pacific Islands, and Alaska.

Even though no nuclear testing activities occurred at the Project Chariot Site, the DOE/NV has been delegated responsibility by the DOE Headquarters (DOE/HQ) to conduct the remedial action at the Project Chariot Site. The organization that sponsored the Project Chariot Site experiments, the AEC, no longer exists

The DOE/NV, in conjunction with the DOE/HQ, is working with the ADEC to develop and implement environmental restoration activities at the Project Chariot Site. The ADEC has placed the Project Chariot Site on the State of Alaska - Contaminated Sites List. The execution of a grant between the DOE and ADEC has been initiated and will detail the DOE program-specific administrative responsibilities. The attachments to the grant will define the responsibilities of the DOE and ADEC for implementing this agreement. The grant will reflect the understanding and commitments regarding the DOE's provision of technical and financial support to the State for environmental oversight and monitoring initiatives to ensure compliance with applicable federal, state, and local regulations at the Project Chariot Site.

Current Issues Related to the Project Chariot Site

In an effort to facilitate the transfer of project-related information to the concerned public in the area of the Project Chariot Site, the DOE and ADEC jointly conducted public meetings in the Village of Point Hope, Alaska, in October 1992. The objectives of the public meetings were to:

- Enable the DOE and ADEC to present their respective agency roles and obligations
- Provide historical and current information on Project Chariot Site
- Provide a forum for the general public to express its concerns relative to Project Chariot Site.

As part of the DOE's commitment to the ADEC and the public, public meetings and the transfer of project information will continue as a scheduled activity within the remedial action project. To encourage public awareness, the Alaska Department of Health and Social Services has also conducted meetings with the local populace concerning Project Chariot Site.

The Project Chariot: 1962 Tracer Study Site Assessment and Remedial Action Plan

The Project Chariot Site, a 1962 Tracer Study Site Assessment and Remedial Action Plan, presents the technical approach and scope of work for the remediation of the soil disposal mound and the verification of attainment of the established clean-up level for the mound and study areas.

Objectives

The objectives of the site assessment remedial action to be performed at Project Chariot are to:

- Present a concise approach and scope of work for the remediation of the soil disposal mound, which is safe, environmentally sound, and cost-effective.
- Present procedures that are consistent with the regulatory requirements, used as a best-engineering practice, for the performance of the site assessment remedial action activities.
- Provide a "working document" based on a logic decision matrix that will enable project personnel to perform in accordance with governing regulations and guidelines. The "working document" is formatted to provide predetermined logic for making field decisions that maintain the continuity of the project and schedule without adversely impacting either the quality of the work or the quality of data collected.
- Provide a strategy for post-excavation sampling of the mound area to verify completeness of the excavation to the established clean-up levels, which will enable an expedited in-field approval of final closure by the ADEC.
- Provide strategies for radiological surveying of the test plot areas to verify that the radioisotopes used in the tracer study have been removed.
- Provide a plan for the sampling and analysis of surface water and sediment in Snowbank Creek to assess any potential transport of radioisotopes from the tracer study and to provide for further site assessment activities including an aerial radiological survey of Ogotoruk and Kisimilok Valleys, a ground survey of tracer plot areas and the mound area and biota sampling for radioactive constituents.

Goals

The project goals for the site assessment and remedial action are to:

- Remediate the soil disposal mound in accordance with the DOE/NV-prepared and the ADEC-approved Site Assessment and Remedial Action Plan

- Perform the remedial action in a safe, environmentally sound, and cost-effective manner

- Excavate and containerize the tracer study generated soil in the disposal mound, to attain the clean-up level, and to secure the ADEC on-site approval of final closure in an expeditious manner

- Perform a radiological survey of the test plot areas to verify that the tracer study radioisotopes have been removed and to secure the ADEC on-site approval of final closure in an expeditious manner

- Perform surface water and sediment sampling and analysis of Snowbank Creek as part of site assessment activities.

These project goals are tiered from and consistent with the objectives presented in the Site Assessment and Remedial Action Plan. To successfully achieve these goals, the continued cooperation and communication between the DOE, ADEC, and the public are critical. The Site Assessment and Remedial Action Plan establishes the project organization, responsibilities, and authority for the participating organizations.

Scope of Work

The scope of the site assessment and remedial action focuses exclusively on the removal of the soil disposal mound at the site, the performance of a radiological survey of the test plot areas, the sampling and analysis of surface water and sediment of Snowbank Creek, background sampling of Kisimilok Valley and biota sampling. The soil disposal mound is located approximately 1.2 km (0.75 mi) north of the original Project Chariot Site camp. Based on historical documents, the estimated volume of soil, including overburden of approximately 1.2 m (4 ft), is 250 m^3 (9,000 ft^3). It is assumed, through a review of documents, that the measurements were a visual interpretation of the mound's dimensions. The June 1993 measurements for the entire mound are 18 by 17 by 1.5 m (57 by 56 by 5 ft). In the best-case scenario, a rectangle was fitted around the mound shape. Given the dimensions of the entire area (18 by 17 m [57 by 56 ft]) and using simple geometry, the dimensions of the rectangle were found to be 17 by 12 m (55 by 39 ft). Estimating with semi-parabolic areas, the best-case scenario for the mound volume is 220 m^3 (290 cubic yards [yd^3]). In the worst-case scenario, the entire square footage outside the mound was used. Therefore, at an estimated maximum, the mound volume is 500 m^3 (650 yd^3).

The site assessment and remedial action will consist of phases:

- Phase I -- Sampling and Analysis. The soil mound will be survey and sampled for disposal waste classification. The analysis results will be used to determine both transportation and disposal requirements.

- Phase II -- Soil Excavation and Containerization. The soil mound will be excavated using heavy equipment and placed in U.S. Department of Transportation (DOT)-approved containers. During the excavation activity, an on-site laboratory equipped with radiological instruments will be utilized to analyze soil samples and to certify decontamination efforts.

- Phase III -- Post-Excavation Sampling and Analysis of the excavated area. Post-excavation soil samples will be collected from the base and sides of the excavation for laboratory analysis (on-site and off-site) to confirm attainment of the clean-up level. This activity will coincide with the excavation operation. In the event that the laboratory results indicate that additional soil removal is required, the area of concern will undergo supplemental excavation and sampling. Upon attainment of the clean-up level and ADEC approval of final closure, the excavated area will be restored to natural grade using on-site soil directly adjacent to the former area and the clean soil cover from the soil mound. The area will be reseeded and covered with excelsior blankets to facilitate seed germination according to the Revegetation Plan (Section 9.0).

- Phase IV -- Transportation and Disposal. The containerized soil will be transported in accordance with DOT regulations and disposed at the NTS.

- Phase V -- Radiological Survey. A radiological survey of the test plots will be performed to verify that the radioisotopes used in the tracer study have been removed. In the event that the survey results indicate that the radioisotopes remain above the established background level, the soil within the area will be manually excavated and containerized for disposal. The area will undergo subsequent surveying to verify that radiation levels are consistent with background readings.

- Phase VI -- Surface Water and Sediment Sampling. The surface water and sediment of Snowbank Creek will be sampled and analyzed at an off-site laboratory to assess any potential transport of radioisotopes from the tracer study.

- Phase VII -- Biota Sampling. Selected flora and fauna of the Ogotoruk and Kisimilok Valleys will be collected and analyzed for radionuclides by an off-site laboratory. Samples of lichens, sedges, and shrub species will be obtained from several locations in the Ogotoruk Valley that were previously studied. Additional sites will be sampled to evaluate the migration of radionuclides from the tracer study mound into soils and vegetation near Snowbank Creek and at a control site (reference) in Kisimilok Valley.

- Phase VIII -- Background sampling. An aerial surface survey and soil sampling will be conducted to establish naturally occurring levels of radionuclides for the undisturbed areas of the Ogotoruk Valley. This will allow for a distinction to be made between "clean" overburden soils and those which may require removal to a licensed facility.

Upon receipt of ADEC approval on the final closure of the mound and the test plot areas, project equipment will be decontaminated and certified as radiological "clean." Prior to demobilization, the disturbed areas will be reseeded with the approved mixture presented in the Revegetation Plan and covered to promote seed germination. Demobilization from the site will follow and include the removal of all project equipment, materials, and personnel from the site.

A project closeout report will be prepared by DOE/NV to document the site activities that were performed, on-site decisions rendered, project records (e.g., photographs, laboratory analyses, QA/QC records, health and safety records, and daily logs), and volume of soil excavated and disposed of. This report will also present the results of the site assessment activities.

Due to the Project Chariot Site location, two major factors that are critical to the implementation of the site assessment remedial action are weather and logistics. Both factors can affect the site operation, thus impacting the proposed schedule. The remoteness of the site and limited access routes require the logistics to be predetermined and contingencies evaluated and established for operations to and from the site and during the performance of the remediation. The weather can also impact both the transportation and remediation activities. Weather will affect, to a degree, the productivity of site operations (labor and equipment). These issues are addressed in the site assessment and remedial action plan, and contingencies are identified. The in-field production rate is based on a seven-day work week and twelve-hour days. The remediation effort will also work a seven-day work week and twelve-hour days. The Site-Specific Health and Safety Plan requirements for on-site personnel safety will take precedence over the schedule.

Schedule for Completion

The on-site remediation and sampling activities are tentatively scheduled to commence in July 1993 and conclude in early September 1993. This schedule has been adopted in response to a written request submitted by the local populace, who have expressed concerns that any site activities conducted between the months of March and June may adversely impact the subsistence hunting season of local villages.

The implementation of the site assessment and remedial action, in accordance with this schedule, is dependent on the following predecessor activities:

- ADEC approval of the Site Assessment and Remedial Action Plan
- Public participation in the remedial action planning process
- National Environmental Policy Act (NEPA) evaluation by the U.S. Fish and Wildlife Service
- Securing all required federal, state, and local permits
- Securing an Access Agreement from the native allotment holder
- Procurement of services and subcontractors in accordance with Federal Procurement Regulations

U.S. DEPARTMENT OF ENERGY
PROJECT CHARIOT:
1962 TRACER STUDY
SITE ASSESSMENT AND
REMEDIAL ACTION PLAN

DOE Nevada Operations Office
Las Vegas, Nevada

July 1993

U.S. DEPARTMENT OF ENERGY
PROJECT CHARIOT:
1962 TRACER STUDY
SITE ASSESSMENT AND
REMEDIAL ACTION PLAN

REVISION 0
JULY 1993

Thomas M. Gerusky — 7/13/93
Thomas M. Gerusky, CHP — Date
Project Director
DOE Headquarters

Stephen A. Mellington — 7/14/93
Stephen A. Mellington — Date
Acting Director, Environmental Restoration Division
DOE Nevada Operations Office

Kevin J. Cabble — 7/14/93
Kevin J. Cabble — Date
Environmental Restoration Project Manager
DOE Nevada Operations Office

Andrea M. Hopkins — 7/14/93
Andrea M. Hopkins, CHMM CEM — Date
Project Manager
IT Corporation, Las Vegas

Cheryl D. Prince — 7/14/93
Cheryl D. Prince — Date
Quality Assurance Officer
IT Corporation, Las Vegas

Brian G. Klenk — 7/14/93
Brian G. Klenk, CIH CEM — Date
Health and Safety Manager
IT Corporation, Las Vegas

Table of Contents

Table of Contents *(Continued)*

Table of Contents (Continued)

Table of Contents (Continued)

Table of Contents *(Continued)*

List of Tables

List of Figures

List of Abbreviations/Acronyms

ADEC	Alaska Department of Environmental Conservation
AEC	U.S. Atomic Energy Commission
AIP	Agreement in Principle
BLM	U.S. Bureau of Land Management
Bq	becquerel
cm	centimeter
cpm	count per minute
CRZ	Contamination Reduction Zone
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
DERP-FUDS	Defense Environmental Restoration Program for Formerly Used Defense Sites
dpm	disintegration per minute
DoD	U.S. Department of Defense
DOE	U.S. Department of Energy
DOE/HQ	U.S. Department of Energy - Headquarters
DOE/NV	DOE Nevada Operations Office
DOT	U.S. Department of Transportation
EA	Environmental Assessment
EPA	U.S. Environmental Protection Agency
EZ	Exclusion Zone
FOIA	Freedom of Information Act
FSP	Field Sampling Plan
FY	Fiscal Year (U.S. Federal Government)
HDPE	high density polyethylene
HSM	Health and Safety Manager
IT	IT Corporation
kg	kilogram
lb	pound
LLW	Low-level waste
LLWCP	Low-Level Waste Certification Plan
LSA	Low Specific Activity
mCi	millicurie
mL	milliliter

mR/hr	milliroentgen per hour
msl	mean sea level
NARL	Naval Arctic Research Laboratory
nCi	nanocurie
NEPA	National Environmental Policy Act
NTS	Nevada Test Site
ORISE	Oak Ridge Institute for Science and Education
PIC	Pressurized Ion Chamber
pCi	picocurie
pCi/g	picocurie per gram
PRG	Preliminary Remediation Goals
psi	pound per square inch
QA	Quality Assurance
QAPjP	Quality Assurance Project Plan
QIP	Quality Implementation Plan
QC	Quality Control
REECo	Reynolds Electrical & Engineering Co., Inc.
SAP	Sampling and Analysis Plan
SDAR	Storage Disposal Approval Record
SOP	Standard Operating Procedure
SSHASP	Site-Specific Health and Safety Plan
SWEA	Solid Waste Engineering Analysis
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WAC	Waste Acceptance Criteria
WRM	Westinghouse Radioactive Material Number
WSDR	Waste Storage Disposal Request
µC	microcoulomb
µCi	microcurie
$\mu Ci/cm^2$	microcurie per square centimeter

Executive Summary

The Project Chariot Site, a 1962 Tracer Study Site Assessment and Remedial Action Plan, presents the technical approach and scope of work for the remediation of the soil disposal mound and the verification of attainment of the established clean-up level for the mound and study areas.

Site History

Project Chariot Site was an experimental part of the United States Atomic Energy Commission's (AEC) Plowshare Program established to test the use of nuclear explosives for peaceful purposes. In 1958, the AEC authorized planning and studies for an experimental harbor excavation in Alaska using nuclear explosives. The primary purpose of this project was to investigate the technical problems and to begin development of a nuclear-excavation technology. At the same time, other studies were underway using nuclear explosives, including a test called Sedan, a cratering experiment carried out at the Nevada Test Site (NTS).

The AEC, with the assistance of other agencies, university researchers, and the Canadian Government, conducted pretest environmental studies in the Cape Thompson Area to allow adequate assessment of the effect of the proposed project and to assure that it could be conducted safely. The commission conducted more than 40 separate environmental investigations, mainly between 1959 and 1961. By 1962, much of the desired nuclear-excavation engineering data originally planned to be obtained in Project Chariot Site activities had become available or would be available from experiments at other sites. The AEC decided in 1962 to suspend Project Chariot Site and to end the associated environmental studies. No nuclear explosive devices were brought to the Project Chariot Site. Many of the environmental study results and site descriptions presented in this plan were published in 1966 in a book entitled *Environment Of the Cape Thompson Region, Alaska* (Wilimovsky and Wolfe, 1966).

During the course of these environmental studies, the U.S. Geological Survey (USGS), under a license granted by AEC's Division of Licensing and Regulation, carried out a five-day

(August 20-25, 1962) radioactive tracer experiment on the soils at the Project Chariot Site. The purpose of this experiment was to measure overland transport of certain radioactive tracers at the site. Small quantities of radioactive tracer material and approximately 6.8 kilograms (kg) (15 pounds [lb]) of soil containing radioactive fallout from the Sedan cratering experiment in Nevada were used for the tests. These measurements were on 12 plots, which were specifically designed to represent a variety of microdrainage patterns. All 12 test plots were adjacent to the headwater forks of Snowbank Creek, about 2.6 kilometers (km) (1.6 miles [mi]) north-northwest from the base camp. The test plots ranged in size from 0.6 by 0.6 meters (m) (2 by 2 feet [ft]) to 1.5 by 2.1 m (5 by 7 ft). The following types and activities of the radioisotopes were used:

Radioisotope	**Activity** (At the time of the test)
Cesium-137 (Cs-137)	2×10^8 becquerels (6 millicuries)
Iodine-131 (I-131)	2×10^8 becquerels (5 millicuries)
Strontium-85 (Sr-85)	2×10^8 becquerels (5 millicuries)
Project Sedan fallout	4×10^8 becquerels (10 millicuries)

The experimental technique involved the following steps:

1. Each of the plots was enclosed with 2.5 by 15-centimeter (cm) (1 by 6-inch [in.]) boards that were wrapped in polyethylene sheeting, set edgewise, and buried sufficiently deep to cut off both surface flow and shallow seepage through the soil.

2. A single tracer was distributed uniformly on each plot, generally over all the plot, but only over one-third of plots 106 and 113. Two of the tracers, Cs-137 and Sr-85, had been acquired in soluble form, dissolved in hydrochloric acid. In the Denver laboratory of the USGS, the radionuclide-bearing acid solution had been buffered and diluted with Na_2CO_3, (sodium carbonate) to a pH of about 5.6 and a concentration of about 0.05 normal, and exchanged onto a local sandy soil that contained very little organic matter. The soil then had been oven dried prior to transport to the Project Chariot Site. At the site, the soil containing the radiological tracers was further mixed with a tundra soil that had been dried and screened and that had fairly large exchange capacity and high organic matter content. The twice-mixed Cs-137 tracer was applied to plots in concentrations of about 4.4×10^3 to 8.9×10^3 becquerels per square centimeter (Bq/cm^2) (0.12 to 0.24 microcuries per square centimeter [$\mu Ci/cm^2$]). Concentrations of the Sr-85 tracer were about 5.6×10^3 to 1.3×10^4 Bq/cm^2 (0.15 to 0.35 $\mu Ci/cm^2$).

A third tracer, I-131, was handled in much the same way except that mixing with the sandy soil at Denver was accomplished by wetting and drying rather than by exchange. The second-stage mixing at the Project Chariot Site was with the same tundra soil as that used to mix the Cs and Sr tracers. The twice-mixed I-131 tracer was applied to plots 109 and 110 in concentrations of about 10 x 10^3 and 2 x 10^3 Bq/cm^2 (0.27 and 0.054 μCi/cm^2), respectively.

The fourth and final tracer was comprised of about 6.8 kg (15 lb) of radioactively-contaminated soil collected about 1.6 km (1 mi) from ground zero of the Sedan detonation at the Nevada Test Site. This tracer was from 45 to 50 days old at the time of these experiments. It comprised diverse fission and activation products, largely attached to particles of Nevada Test Site alluvium. It was not further mixed at the Project Chariot Site. Of this fallout tracer, about 3 x 10^6 Bq (70 μCi) were applied to each of three plots (113, 114, and 115), resulting in concentrations from about 3.6 x 10^2 to 4.4 x 10^3 Bq/cm^2 (0.0097 to 0.12 μCi/cm^2).

3. To simulate rainfall, water was drawn from Snowbank Creek by a portable gasoline-powered pump and applied to the plots through hose and spray nozzle. The test plots were located at a distance no greater than 20 m (60 ft) from the creek. Among the 12 plots, four received one such application, four received two applications each, and two received seven applications in succession. Each application was sufficient to transiently saturate the surface soil of the plot and to generate ephemeral runoff. The amount of simulated rain was measured in several gages (50-milliliter [mℓ] beakers); the range was between 0.64 and 4.95 cm (0.25 and 1.95 in.) per application and, in total, between 3.53 and 14.7 cm (1.39 and 5.78 in.) per test. Intensity of the simulated rainfall was substantially greater than would be expected to occur naturally.

4. Samples of the generated runoff were taken in 100-mℓ polyethylene bottles for transport to the laboratory at Denver to determine radioactivity. Also, samples of soil on several plots were taken to a depth of 1 cm (0.4 in.), for determinations of bulk density and radioactivity. On the plots to which simulated rain was applied more than once, runoff was intermittent and was regenerated by each application; each generation of runoff was sampled separately. Radioactivity due to Sr-85 and I-131 was determined by appropriate counting on 2-mℓ aliquots of runoff; that due to Cs-137 or to mixed products from Sedan fallout was first counted on 2-mℓ aliquots and later recounted on the residual samples.

In addition to the overland transport tracer study, underground transport of radionuclides was appraised by a simple 18-hour percolation test in August 1962 on a hillside above Snowbank Creek (plot 62 ABJ 116). A small pit was dug through a surface layer of humus-rich soil 15 cm (5.9 in.) thick, and about 10 cm (4 in.) into underlying silt and clay. The pit was filled to within 5 cm (2 in.) of its rim with 1.4 kg (3 lb) of Sedan soil mixed into a slurry with creek water. The pit was refilled three times with additional water. The resultant percolate was sampled in a trench dug 84 cm (33 in.) downslope from the pit. Samples were taken in 100-mℓ polyethylene bottles at 15-minute intervals during the first four hours and then once after 18 hours. At the end of the test, soil samples were taken from a subsidiary trench dug from the pit to the percolate trench. This test showed the attenuation of radionuclides adsorbed or exchanged from percolating or infiltrating water.

A sediment transport experiment was conducted on a small tributary of Snowbank Creek, which was identified as test plot 117. The reach chosen was of fairly uniform slope and cross section and had a flow rate of approximately 60 liters per minute (lpm) (16 gallons per minute [gpm]). The flow rate was determined by catching the total discharge of the stream over a small waterfall in a bucket for measured lengths of time. The stream was measured off into 6-m (20-ft) reaches. After samplers were located at the 6-, 12-, and 18-m (20-, 40-, and 60-ft) stations, a slurry containing approximately 2.47 kg (5.44 lb) of Sedan soil was introduced as a single injection slug at the zero station of the test reach. Simultaneous samples of water were collected at one-minute intervals in 1-ounce (oz) polyethylene bottles at the 6-, 12-, and 18-m (20-, 40-, and 60-ft) sampling points. Fifteen minutes after introduction of the Sedan soil slurry, the stream bottom at the point of introduction was vigorously agitated to dispense any of the slurry that may have been absorbed or settled on the stream bottom. Sampling was continued until a total time of 20 minutes had elapsed from the time of the initial introduction. All samples were transported for analysis to the USGS laboratory in Denver, Colorado.

Following completion of each test plot experiment and the percolation test, the soil was removed and transported to a waste disposal area in half-filled 55-gallon drums. Four to six half-filled drums of soil were collected for disposal. The excavated soil was poured from the drums and mixed with the in-situ site soils. The rationale behind the mixing of the soils was to disguise the isotopic ratios, for security reasons. According to historical documents, this process generated approximately 45 cubic meters (m^3) (1,600 cubic feet [ft^3]) of soil, in a mound 0.46 m (1.5 ft) thick over an area of 4 square meters (m^2) (40 square feet [ft^2]). The 2.5 by 15-cm (1 by 6-in.) boards and polyethylene sheeting were also disposed with the soil. This soil was then covered with up to 2 m (4 ft) of clean soil. The average activity concentration of the radioactivity in the soil at the time of emplacement was approximately 9.6 becquerels per gram (Bq/g) (0.26 nanocuries per gram [nCi/g]).

Both I-131 and Sr-85 have half-lives of less than 70 days. Therefore, both of these isotopes have essentially decayed away, leaving only the longer half-life Cs-137 (30 years) and Sedan fallout with half-lives of 3 years or greater. The present activity concentration of radioactivity in the soil is estimated to be 1.1 Bq/g (0.03 nCi/g), with a total activity of less than 1.1×10^8 Bq (3 mCi) for the entire mound. Based on the risk assessment review performed by Oak Ridge Institute for Science and Education (ORISE), neither the current level of radioactivity or the activity present in 1962 poses a risk to human health or the environment.

In accordance with the Health Intervention Plan for Point Hope, the Alaska Division of Public Health has reviewed all available health information and generated a report titled, *Health Risk Assessment of Radioisotopes at Cape Thompson, Alaska*, November 24, 1992. This report concluded that the radioisotopes at Cape Thompson present no health risk to subsistence hunters in the area or to persons living in nearby villages. Also, the report states that radioisotopes have never presented a risk and will not present a risk if left in their present state.

On April 28, 1963, the site of the soil test was transferred to the Naval Arctic Research Laboratory (NARL). The buildings, airstrip, and the structural improvements placed at this site were used by the U.S. Navy, and additional structures were built. The NARL ceased operations at the site in 1970, and the site was transferred to the Bureau of Land Management (BLM). The site was later transferred to the U.S. Fish and Wildlife Service (USFWS) in 1980, with the exception of two individual Native Allotments. When the U.S. Army Corps of Engineers performed the initial field investigation at the site, areas of potential environmental concern were identified and included debris, structures, and waste materials. Based on these findings, the site was identified as a potential Defense Environmental Restoration Program for Formerly Used Defense Sites (DERP-FUDS). The location was verified through real estate records maintained at the U.S. Army Engineer District, Alaska. The Department of Defense (DoD) approved this site under the DERP-FUDS program on August 8, 1988. A Remedial Action contract was awarded in fiscal year (FY) 1990 for the clean up of unsafe debris and buildings, petroleum containers, and contaminated soils. The Remedial Action was performed and completed during the summer of 1992.

Recently, a researcher at the University of Alaska at Fairbanks obtained two letters under the Freedom of Information Act (FOIA), written in the early 1960s from the USGS to the AEC. These two pieces of correspondence focused on the use of radioactive isotopes at this site during the performance of the investigations associated with the AEC's Project Chariot Site during the early 1960s. The letter also addressed the isotope materials buried at the site at the conclusion of the experiment.

In response to concerns raised through the publication of this information by the news media and heightened local political interest facilitated by public concern, the Alaska Department of Environmental Conservation (ADEC) and the U.S. Army Corps of Engineers conducted a site investigation on September 10 to 14, 1992. The surface radioactivity survey indicated no readings above background levels. No visible signs of stressed vegetation were observed. A hole was power-augured diagonally into the southwest surface of the mound. Readings were not distinguishable above background until a depth of approximately 1.1 m (3.5 ft), where a reading of 0.1 milliroentgens per hour (mR/hr) was recorded. However, based on a U.S. Department of Energy (DOE) review of the video tape of the measurements, the results should only be used for qualitative information, due to the sampling methodology employed.

On October 21, 1992, representatives from the DOE Nevada Operations Office (DOE/NV), IT Corporation, ADEC, and Point Hope and Barrow residents performed a site inspection. The objectives of the site inspection were to assess the soil disposal mound; to perform a radiation survey of the mound surface; to inspect and access logistically important facilities at the site (airfields); and to inspect the buildings at the site for potential use. No readings were registered above background at the surface of the soil disposal mound using a gamma scintillation counter, an alpha scintillation probe, and a beta/gamma Geiger-Mueller pancake probe.

Based upon all available information, the DOE's position is that the disposal mound has never nor will it ever present a hazard to the public or the environment. Upon evaluation of potential costs for further investigations at the site and complicated logistic issues, the DOE determined that the implementation of a remedial action was the most cost-effective approach.

U.S. Department of Energy Environmental Restoration Program. In 1990, the DOE/NV initiated an Environmental Restoration Program as part of an overall national program. This program is investigating and addressing environmental issues at all locations where nuclear weapons testing has been conducted by the United States government including test sites in Nevada, Mississippi, Colorado, New Mexico, Pacific Islands, and Alaska.

Even though no nuclear testing activities occurred at the Project Chariot Site, the DOE/NV has been delegated responsibility by the DOE Headquarters (DOE/HQ) to conduct the remedial action at the Project Chariot Site. The organization that sponsored the Project Chariot Site experiments, the AEC, no longer exists

The DOE/NV, in conjunction with the DOE/HQ, is working with the ADEC to develop and implement environmental restoration activities at the Project Chariot Site. The ADEC has placed the Project Chariot Site on the State of Alaska - Contaminated Sites List. The execution of a grant between the DOE and ADEC has been initiated and will detail the DOE program-specific administrative responsibilities. The attachments to the grant will define the responsibilities of the DOE and ADEC for implementing this agreement. The grant will reflect the understanding and commitments regarding the DOE's provision of technical and financial support to the State for environmental oversight and monitoring initiatives to ensure compliance with applicable federal, state, and local regulations at the Project Chariot Site.

Current Issues Related to the Project Chariot Site. In an effort to facilitate the transfer of project-related information to the concerned public in the area of the Project Chariot Site, the DOE and ADEC jointly conducted public meetings in the Village of Point Hope, Alaska, in October 1992. The objectives of the public meetings were to:

- Enable the DOE and ADEC to present their respective agency roles and obligations
- Provide historical and current information on Project Chariot Site
- Provide a forum for the general public to express its concerns relative to Project Chariot Site.

As part of the DOE's commitment to the ADEC and the public, public meetings and the transfer of project information will continue as a scheduled activity within the remedial action project. To encourage public awareness, the Alaska Department of Health and Social Services has also conducted meetings with the local populace concerning Project Chariot Site.

Site Assessment and Remedial Action Objectives. The objectives of the site assessment remedial action to be performed at Project Chariot are to:

- Present a concise approach and scope of work for the remediation of the soil disposal mound, which is safe, environmentally sound, and cost-effective.

- Present procedures that are consistent with the regulatory requirements, used as a best-engineering practice, for the performance of the site assessment remedial action activities.

- Provide a "working document" based on a logic decision matrix that will enable project personnel to perform in accordance with governing regulations and guidelines. The "working document" is formatted to provide predetermined logic for making field decisions that maintain the continuity of the project and schedule without adversely impacting either the quality of the work or the quality of data collected.

- Provide a strategy for post-excavation sampling of the mound area to verify completeness of the excavation to the established clean-up levels, which will enable an expedited in-field approval of final closure by the ADEC.

- Provide strategies for radiological surveying of the test plot areas to verify that the radioisotopes used in the tracer study have been removed.

- Provide a plan for the sampling and analysis of surface water and sediment in Snowbank Creek to assess any potential transport of radioisotopes from the tracer study and to provide for further site assessment activities including an aerial radiological survey of Ogotoruk and Kisimilok Valleys, a ground survey of tracer plot areas and the mound area and biota sampling for radioactive constituents.

Project Goals. The project goals for the site assessment and remedial action are to:

- Remediate the soil disposal mound in accordance with the DOE/NV-prepared and the ADEC-approved Site Assessment and Remedial Action Plan

- Perform the remedial action in a safe, environmentally sound, and cost-effective manner

- Excavate and containerize the tracer study generated soil in the disposal mound, to attain the clean-up level, and to secure the ADEC on-site approval of final closure in an expeditious manner

- Perform a radiological survey of the test plot areas to verify that the tracer study radioisotopes have been removed and to secure the ADEC on-site approval of final closure in an expeditious manner

- Perform surface water and sediment sampling and analysis of Snowbank Creek as part of site assessment activities.

These project goals are tiered from and consistent with the objectives presented in the Site Assessment and Remedial Action Plan. To successfully achieve these goals, the continued cooperation and communication between the DOE, ADEC, and the public are critical. The Site Assessment and Remedial Action Plan establishes the project organization, responsibilities, and authority for the participating organizations.

Site Assessment and Remedial Action Scope of Work. The scope of the site assessment and remedial action focuses exclusively on the removal of the soil disposal mound at the site, the performance of a radiological survey of the test plot areas, the sampling and analysis of surface water and sediment of Snowbank Creek, background sampling of Kisimilok Valley and biota sampling. The soil disposal mound is located approximately 1.2 km (0.75 mi) north of the original Project Chariot Site camp. Based on historical documents, the estimated volume of soil, including overburden of approximately 1.2 m (4 ft), is 250 m^3 (9,000 ft^3). It is assumed, through a review of documents, that the measurements were a visual interpretation of the mound's dimensions. The June 1993 measurements for the entire mound are 18 by 17 by 1.5 m (57 by 56 by 5 ft). In the best-case scenario, a rectangle was fitted around the mound shape. Given the dimensions of the entire area (18 by 17 m [57 by 56 ft]) and using simple geometry, the dimensions of the rectangle were found to be 17 by 12 m (55 by 39 ft). Estimating with semi-parabolic areas, the best-case scenario for the mound volume is 220 m^3 (290 cubic yards [yd^3]). In the worst-case scenario, the entire square footage outside the mound was used. Therefore, at an estimated maximum, the mound volume is 500 m^3 (650 yd^3).

The site assessment and remedial action will consist of phases:

- Phase I -- Sampling and Analysis. The soil mound will be survey and sampled for disposal waste classification. The analysis results will be used to determine both transportation and disposal requirements.

- Phase II -- Soil Excavation and Containerization. The soil mound will be excavated using heavy equipment and placed in U.S. Department of Transportation (DOT)-approved containers. During the excavation activity, an on-site laboratory equipped with radiological instruments will be utilized to analyze soil samples and to certify decontamination efforts.

- Phase III -- Post-Excavation Sampling and Analysis of the excavated area. Post-excavation soil samples will be collected from the base and sides of the excavation for laboratory analysis (on-site and off-site) to confirm attainment of the clean-up level. This activity will coincide with the excavation operation. In the event that the laboratory results indicate that additional soil removal is required, the area of concern will undergo supplemental excavation and sampling. Upon attainment of the clean-up level and ADEC approval of final closure, the excavated area will be restored to natural grade using on-site soil directly adjacent to the former area and the clean soil cover from the soil mound. The area will be reseeded and covered with excelsior blankets to facilitate seed germination according to the Revegetation Plan (Section 9.0).

- Phase IV -- Transportation and Disposal. The containerized soil will be transported in accordance with DOT regulations and disposed at the NTS.

- Phase V -- Radiological Survey. A radiological survey of the test plots will be performed to verify that the radioisotopes used in the tracer study have been removed. In the event that the survey results indicate that the radioisotopes remain above the established background level, the soil within the area will be manually excavated and containerized for disposal. The area will undergo subsequent surveying to verify that radiation levels are consistent with background readings.

- Phase VI -- Surface Water and Sediment Sampling. The surface water and sediment of Snowbank Creek will be sampled and analyzed at an off-site laboratory to assess any potential transport of radioisotopes from the tracer study.

- Phase VII -- Biota Sampling. Selected flora and fauna of the Ogotoruk and Kisimilok Valleys will be collected and analyzed for radionuclides by an off-site laboratory. Samples of lichens, sedges, and shrub species will be obtained from several locations in the Ogotoruk Valley that were previously studied. Additional sites will be sampled to evaluate the migration of radionuclides from the tracer study mound into soils and vegetation near Snowbank Creek and at a control site (reference) in Kisimilok Valley.

- Phase VIII -- Background sampling. An aerial surface survey and soil sampling will be conducted to establish naturally occurring levels of radionuclides for the undisturbed areas of the Ogotoruk Valley. This will allow for a distinction to be made between "clean" overburden soils and those which may require removal to a licensed facility.

Upon receipt of ADEC approval on the final closure of the mound and the test plot areas, project equipment will be decontaminated and certified as radiological "clean." Prior to demobilization, the disturbed areas will be reseeded with the approved mixture presented in the Revegetation Plan and covered to promote seed germination. Demobilization from the site will follow and include the removal of all project equipment, materials, and personnel from the site.

A project closeout report will be prepared by DOE/NV to document the site activities that were performed, on-site decisions rendered, project records (e.g., photographs, laboratory analyses, QA/QC records, health and safety records, and daily logs), and volume of soil excavated and disposed of. This report will also present the results of the site assessment activities.

Due to the Project Chariot Site location, two major factors that are critical to the implementation of the site assessment remedial action are weather and logistics. Both factors can affect the site operation, thus impacting the proposed schedule. The remoteness of the site and limited access routes require the logistics to be predetermined and contingencies evaluated and established for operations to and from the site and during the performance of the remediation. The weather can also impact both the transportation and remediation activities. Weather will affect, to a degree, the productivity of site operations (labor and equipment). These issues are addressed in the site assessment and remedial action plan, and contingencies are identified. The in-field production rate is based on a seven-day work week and twelve-hour days. The remediation effort will also work a seven-day work week and twelve-hour days. The Site-Specific Health and Safety Plan requirements for on-site personnel safety will take precedence over the schedule.

Schedule for Completion. The on-site remediation and sampling activities are tentatively scheduled to commence in July 1993 and conclude in early September 1993. This schedule has been adopted in response to a written request submitted by the local populace, who have expressed concerns that any site activities conducted between the months of March and June may adversely impact the subsistence hunting season of local villages.

The implementation of the site assessment and remedial action, in accordance with this schedule, is dependent on the following predecessor activities:

- ADEC approval of the Site Assessment and Remedial Action Plan
- Public participation in the remedial action planning process
- National Environmental Policy Act (NEPA) evaluation by the U.S. Fish and Wildlife Service
- Securing all required federal, state, and local permits
- Securing an Access Agreement from the native allotment holder
- Procurement of services and subcontractors in accordance with Federal Procurement Regulations

1.0 Introduction

The U.S. Department of Energy (DOE) will conduct a site assessment and a remedial action at the Project Chariot site in the Cape Thompson Region, Alaska, During the months of June through September, 1993. These activities will address the potential environmental impacts resulting from the 1962 Tracer Study conducted by the U.S. Geological Survey for the DOE.

A draft Project Chariot: 1962 Tracer Study Remedial Action Plan was developed and released for comment in February, 1993. This remedial action plan has been revised to include expanded assessment activities in response to comments provided by the involved government agencies and the public. The additional assessment activities include an aerial photographic survey, an aerial radiological survey, a ground radiological survey, biota sampling, surface water, sediment and soil sampling in the former tracer plot areas.

Surface waters and sediments of Snowbank and Ogotoruk Creeks, soils in Ogotoruk Valley, and biota indigenous to Ogotoruk and Kisimilok Valleys will be analyzed. The aerial surveys will address both Ogotoruk and Kisimilok Valleys.

The specific details regarding numbers of samples, numbers and types of instruments, on-site laboratory analyses, off-site laboratory analyses, sample media, sample location, replicate samples and spiked samples are detailed in the Sampling and Analysis Plan, Appendix A.

The sampling strategy presented in the sampling and analysis plan has been developed based on detailed process knowledge of the radioisotopes used in the Tracer Study of 1962. Historical documents and personal interviews with scientists who conducted the original study provide the basis for this process knowledge.

The results of the sampling and analysis will provide the basis for an exposure analysis which will be detailed in the final report.

1.1 Objectives and Scope of the Site Assessment and Remedial Action Plan

The objectives of this Site Assessment and Remedial Action Plan are to:

- Present a concise approach and scope of work for the remediation of the tracer study soil disposal mound, which is safe for all personnel, environmentally sound, and cost-effective
- Present procedures that are consistent with the regulatory requirements, used as a best-engineering practice, for the performance of remedial action activities
- Provide a "working" document based on a logic decision matrix that will enable project personnel to perform in accordance with governing regulations and guidelines. This working document is formatted to provide predetermined logic for making field decisions that maintain the continuity of the project and schedule, without adversely impacting either the quality of the work or the quality of the data collected
- Provide a strategy for post-excavation soil sampling of the mound area to verify completeness of the excavation to the site's established clean-up level, which will enable an expedited in-field approval of final closure by the Alaska Department of Environmental Conservation (ADEC)
- Provide strategies for radiological surveying of the test plot areas to verify that the radioisotopes used in the tracer study have been removed and for the sampling and analysis of surface water and sediment in Snowbank Creek to assess any potential transport of radioisotopes from the tracer study
- Provide for biota sampling
- Provide for background sampling
- Provide for an aerial radiological survey of Ogotoruk and Kisimilok Valleys.

1.2 Site Assessment Activities

Site assessment field activities are described in Table 1-1. The sampling media include ground surveys through aerial photographic and radiological instrumentation, surface water and sediment sampling, biota sampling and soil sampling.

The radiological surveys of the ground of Ogotoruk Valley will occur in two phases: an aerial survey and a walkover ground survey. The objectives of these surveys are to collect radioactivity data on the Ogotoruk Valley to provide a basis for establishing background radioactivity in the Valley, provide data on the soil disposal mound and the former test plots

Table 1-1
Summary of Environmental Assessment and Remedial Action Verification Samples

Sample Type	Location	Quantity[1, 2]	Lab Requirements
Water	Snowbank Creek	7	Off-Site
	Tributary 3 of Snowbank Creek	7	Off-Site
	Ogotoruk Creek	5	Off-Site
	Ephemeral Pond	2	Off-Site
Sediment	Snowbank Creek	7	Off-Site
	Tributary 3 of Snowbank Creek	7	Off-Site
	Ogotoruk Creek	5	Off-Site
	Ephemeral Pond	2	Off-Site
Vegetation	Ogotoruk Valley	102	Off-Site
	Kisimilok Valley	40	Off-Site
Mammals	Ogotoruk Valley	49-70[3]	Off-Site
	Kisimilok Valley	10	Off-Site
Soil	Test Plot and Radiological Ground Survey	26 per identified test plot 4 composites per radiation "hot spot"	On-Site[4] On-Site[4]
	Disposal Mound	4 (composites)	On-Site and Off-Site
	Excavated Site	4 (composites)	On-Site and Off-Site
	Waste Characterization	4 plus 1	Off-Site
	Background	40	On-Site and Off-Site

[1]Does not include QC samples.

[2]This is the minimum specified in SAP. If contaminants are encountered, the number of samples will increase.

[3]Number of samples collected is dependent upon population levels, occurrences and habitat.

[4]Off-site laboratory will analyze all soil samples for gross alpha and gross beta and 10% for gamma spec as verification of on-site lab analysis

by identifying any radioactive anomalies and to collect data on Kisimilok Valley for purposes of comparison.

The data collected from the aerial survey will be analyzed on-site. Any unexplained anomalies will be surveyed during the ground survey activities (ground truthed).

The ground survey will focus on the collection of data at the soil disposal mound, the test plot areas and any anomalous areas identified during the aerial radiological survey.

The objectives of the radiological ground survey are to collect data at the surface of the disposal mound for exposure data, locate the test plot areas if possible and remove any soil in and around the areas that evidences contamination above the action level.

Surface water and sediment samples will be collected from Snowbank and Ogotoruk Creeks and any standing water adjacent to the mound. The objectives for collection of these samples are to determine if there are any impacts to the Creek areas due to potential migration from the test plots and the soil disposal mound and any standing water and to remediate these areas if necessary. Data from these analyses will be used in the exposure analysis.

Biota samples will be taken from the test plots areas and the disposal mound area. Types of samples will consist of birds, fish, vegetation and land mammals. The objectives for this sampling are to compare current sampling data with 1962 Project Chariot biota sampling data to determine any impacts and to provide data for the exposure analysis.

Soil samples will be collected at two depths; surface and at the interface formed by the surface soil and the permafrost. The locations for soil sampling are along the perimeter of the disposal mound, in the test plot areas and around the areas identified by the aerial radiological and ground radiological surveys. The objectives for this survey are to establish background levels for radioactivity in soils in the Ogotoruk Valley for use in the exposure analysis and to determine any migration of radioisotopes from the disposal mound, the test plots and any anomalous areas highlighted by the aerial surveys.

Site assessment activities and logic diagrams are presented in Figures 1-1 through 1-4.

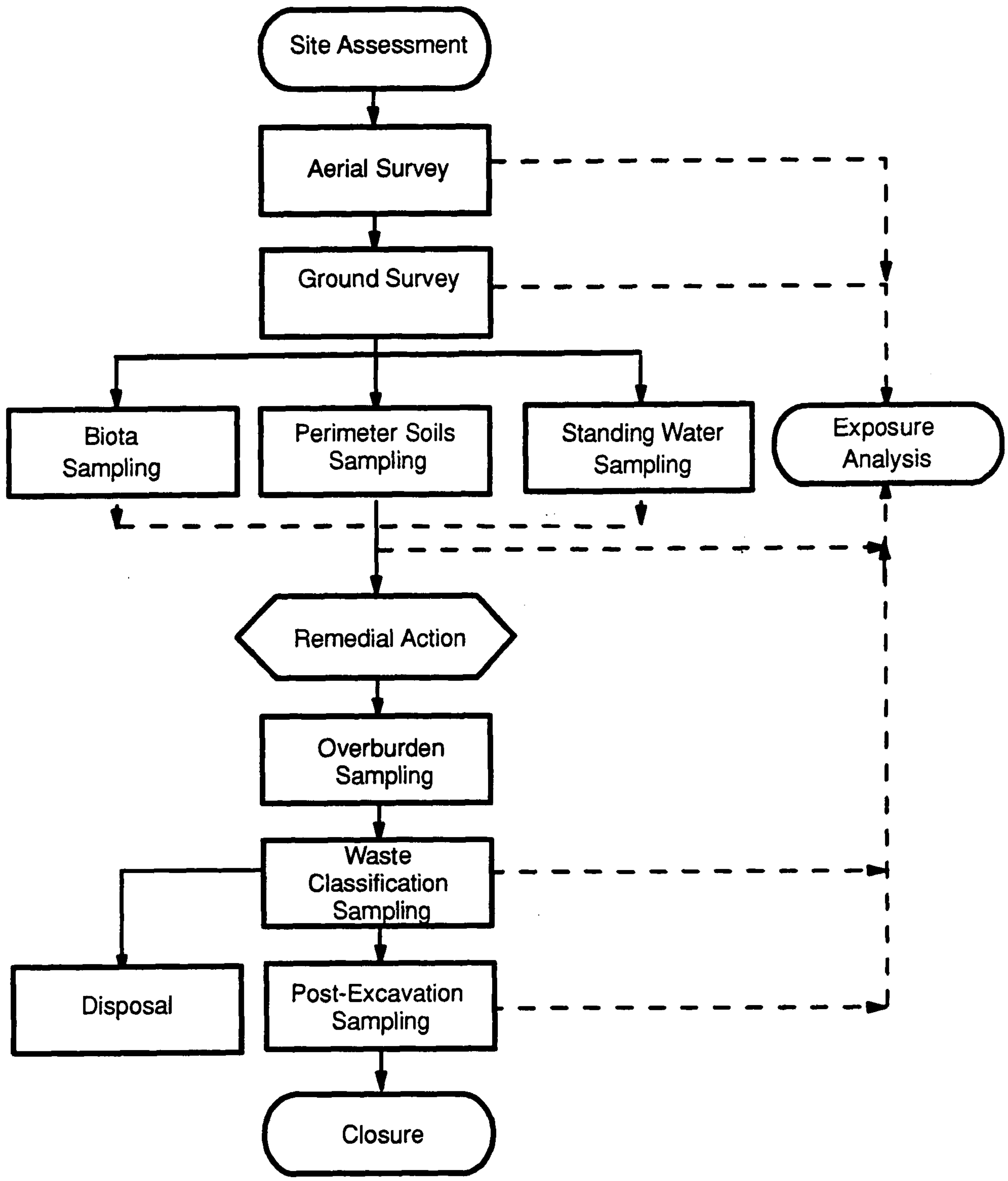
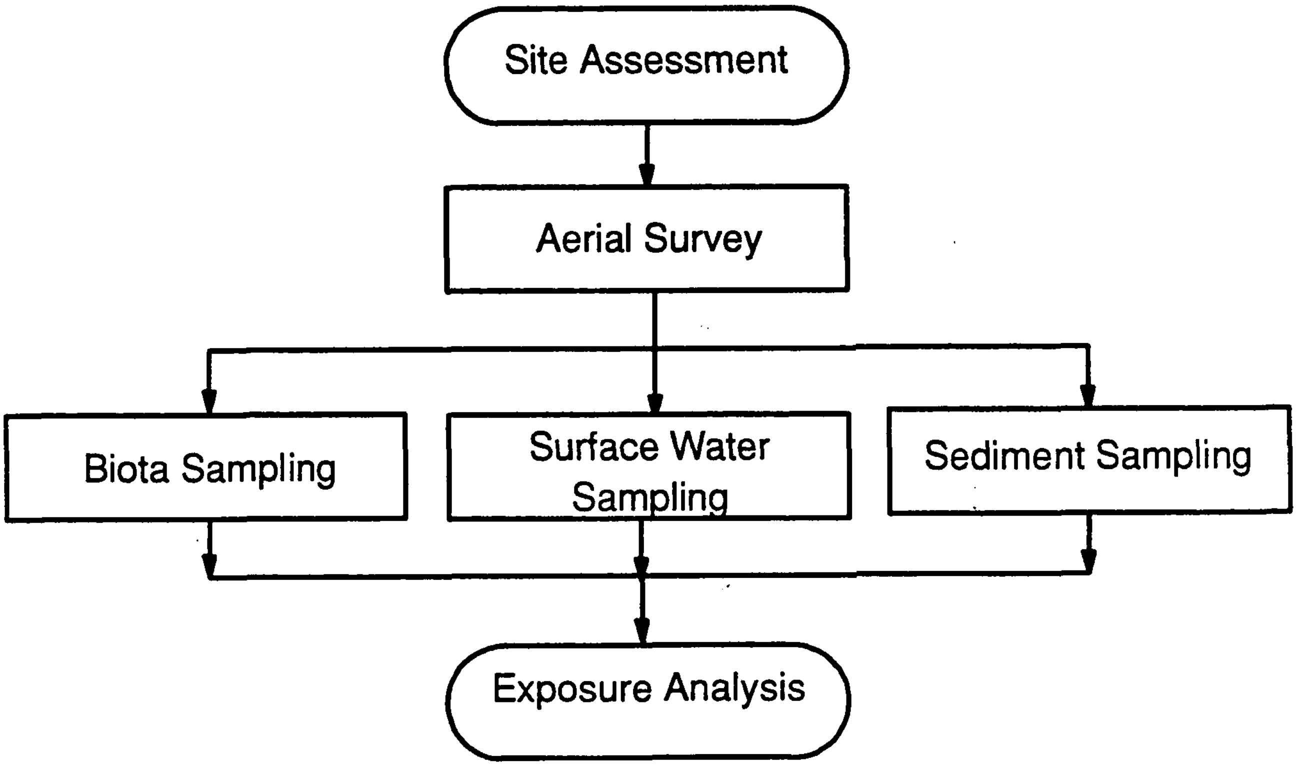


Figure 1-1
Soil Disposal Mound Logic Diagram



- Sampling Locations to focus on AREAS OF INTEREST
- Surface Water and Sediment samples to focus on areas of depositional environment
- Background samples will be collected up-gradient from the locations of the 1962 Tracer Study.

Figure 1-2
Snowbank & Ogotoruk Creeks Logic Diagram

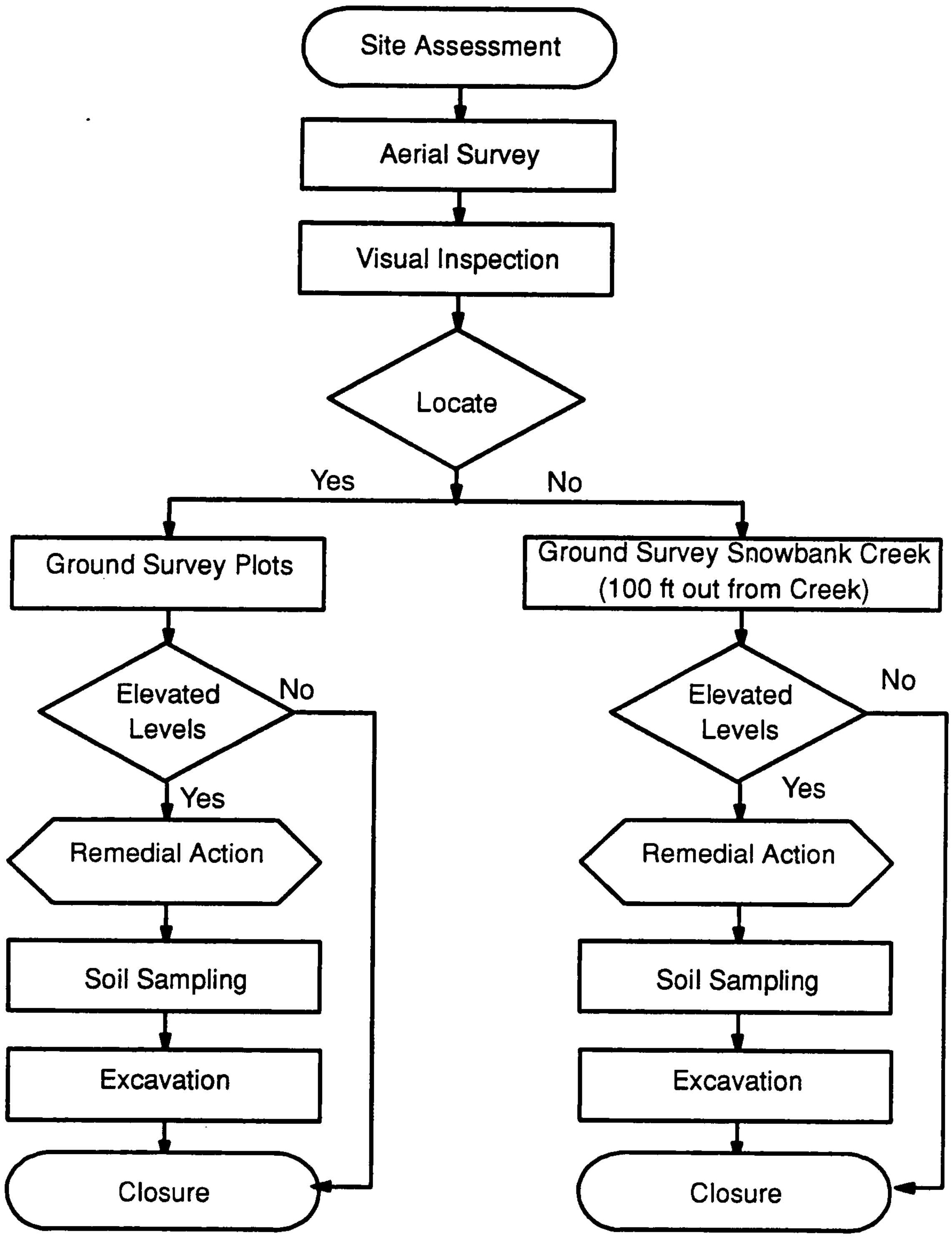


Figure 1-3
1962 Tracer Study Test Plots Logic Diagram

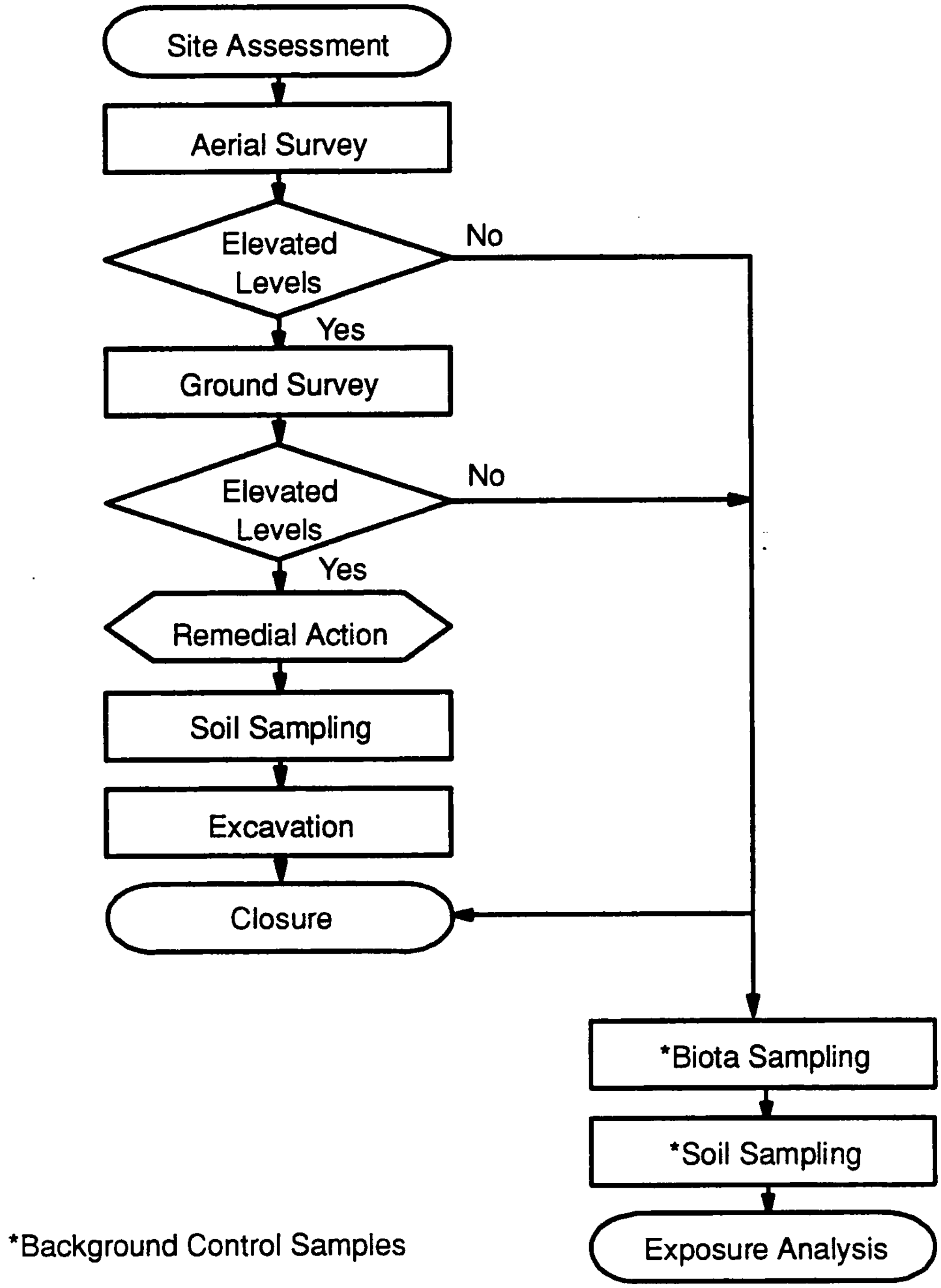


Figure 1-4
Ogotoruk Valley Logic Diagram

1.3 Remediation Activities

The scope of the remedial action focuses on the excavation, containerization, and disposal of the soil disposal mound at the Project Chariot site. The soil disposal mound is located approximately 1.2 kilometers (km) (0.75 mile [mi]) north of the original Project Chariot base camp. Based on and measurements taken of the mound's dimensions in June 1993, the estimated volume of soil, including up to 1.2 meters (m) (4 feet [ft]) of clean overburden, ranges from 220 cubic meters (m^3) (290 cubic yards [yd^3]) to 500 m^3 (650 yd^3).

A mound dimension of 18 m (57 ft) in width by 17 m (56 ft) in length with a 1.7-m (5-ft) height will be used for the soil volume estimate for the entire mound, including "clean" overburden. The north face of the mound has a very gentle slope and the south face of the mound is much steeper. Willows were observed all around the mound, except for the peak. The ephemeral pond is located to the south of the mound by several feet. The areas downgradient from the mound are marshy.

The historical photographs taken in 1962 during the tracer study illustrate the phased formation of the soil disposal mound and served as a basis to document assumptions of the volume of soil generated by the tracer study. These assumptions have been confirmed during the DOE-conducted interviews with the individuals who performed the study and who were present during the formation of the soil disposal mound. The tracer-study-generated soil was emptied from the 55-gallon drums directly onto the native soil. The wooden boards and polyethylene sheeting were also placed with this soil. Based on the review and evaluation of the historical photographs, the area dimensions occupied by this soil is estimated to be approximately 12 m (40 ft) in width, 12 m (40 ft) in length, and up to 0.46 m (1.5 ft) in depth. This dimension of the tracer-study soil pile will result in approximately 45 m^3 (1,600 cubic feet [ft^3]) of tracer-study-generated soil. The in-place soil density at the project site, as published by the U.S. Geological Survey (USGS) *Environment of the Cape Thompson Region, Alaska* (Wilimovsky and Wolfe, 1966) is 1.98 grams per cubic centimeter (g/cm^3) (124.8 pounds per cubic foot [lb/ft^3]). Thus, the estimated weight of the soil to be excavated for disposal is 90 metric tons (100 tons). Using an engineering-estimated bulking factor of 30 percent for the site soil after excavation, the estimated volume of soil to be containerized and disposed is approximately 60 m^3 (2,100 ft^3).

1.4 Site Assessment and Remediation Phases

The site assessment and remedial action consists of eight phases:

- Phase I -- Sampling and Analysis. Sampling and analysis of soil composing the mound for waste disposal classification will be done. The analysis results will be utilized to determine both transportation and disposal requirements.

- Phase II -- Soil Excavation and Containerization. Predecessor activities will include the mobilization of project equipment, materials and personnel to the site; the establishment of the base camp; and the completion of site preparation activities. The soil mound will be excavated using heavy equipment and containerized in Department of Transportation (DOT)-approved B-25 Low Specific Activity (LSA) containers. During the excavation activity, an on-site laboratory equipped with portable radiological instruments will be utilized to field-screen soil samples and to certify decontamination efforts. Upon receipt of ADEC approval of final closure, equipment will be decontaminated and demobilization of the site will begin.

- Phase III -- Post-Excavation Sampling and Analysis. Post-excavation soil samples will be collected from the base and sides of the excavation for laboratory analysis to confirm attainment of the established clean-up level. This activity will coincide with the excavation operation. In the event that the laboratory results indicate that additional soil removal is required, the area of concern will undergo supplemental excavation and sampling. Upon achieving the clean-up level and ADEC on-site approval of final closure, the excavated area will be restored to natural grade using on-site soils excavated from the top of the mound.

- Phase IV -- Transportation and Disposal. The containerized soil will be transported in accordance with DOT regulations and disposed of at the NTS.

- Phase V -- Radiological Survey. A radiological survey of the test plot areas will be performed to verify that the radioisotopes used in the tracer study have been removed. In the event that the survey results indicate that the radioisotopes remain above the established clean-up level, the soil within the area will be manually excavated and containerized for disposal. The area will undergo a subsequent radiological survey to verify attainment of the clean-up level.

- Phase VI -- Surface Water and Sediment Sampling. The surface water and sediment of Snowbank Creek its tributaries and Ogotoruk will be sampled and analyzed at an off-site laboratory to assess any potential transport of radioisotopes from the tracer study.

- Phase VII -- Biota Sampling. Selected flora and fauna of the Ogotoruk and Kisimilok Valleys will be collected and analyzed for radionuclides by an off-site laboratory. Samples of lichens, sedges, and shrub species will be obtained from several locations in the Ogotoruk Valley that were previously studied. Additional sites will be sampled to evaluate the migration of radionuclides from the tracer study mound into soils and vegetation near snowbank creek and at a control site (reference) in Kisimilok valley.

- Phase VIII -- Background. An aerial surface survey and soil sampling will be conducted to establish naturally occurring levels of radionuclides for the undisturbed areas of the Ogotoruk Valley. This will allow for a distinction to be made between "clean" overburden soils and those which may require removal to a licensed facility.

A project closeout report that documents the remedial action will be prepared by the U.S. Department of Energy, Nevada Operations Office (DOE/NV).

To ensure consistency with regulatory requirements and established procedures, relevant Environmental Protection Agency (EPA) guidance documents were consulted in the preparation of this Site Assessment and Remedial Action Plan, and are being used as a best-engineering practice, including but not limited to:

- *A Compendium of Superfund Field Operations Methods,* EPA/540/P-87/001, (OSWER Directive 9355.0-14), December 1987

- *Remedial Actions at Waste Disposal Sites (Revised), Handbook,* EPA/625/6-85/006

- *Superfund Remedial Design and Remedial Action Guidance,* EPA, (OSWER Directive 9355.0-14), June 1986

- *Data Quality Objectives for Remedial Response Activities* (EPA, 1987)

1.5 Project Goals

The project goals for the remedial action are to:

- Remediate the soil disposal mound in accordance with the DOE/NV-prepared and the ADEC-approved Site Assessment and Remedial Action Plan

- Perform the remedial action in a safe, environmentally sound, and cost-effective manner

- Excavate and containerize the soil mound, to attain the established clean-up level, and to secure the ADEC on-site approval of final closure in an expeditious manner

- Perform a radiological survey of the test plot areas to verify that the tracer-study radioisotopes have been removed and to secure the ADEC on-site approval of final closure in an expeditious manner

- Perform surface water and sediment sampling and analysis of Snowbank Creek to assess any potential transport of radioisotopes.

- Obtain samples of selected biological organisms from the Project Chariot environs to make an informed decision as to the radiological significance of the Tracer study, upon the biota.

- Collect background soil and biota samples from undisturbed locations in Ogotoruk Valley that display soil and vegetation characteristics similar to the area of the disposal mound.

These project goals are tiered from and consistent with the objectives presented in the Site Assessment and Remedial Action Plan. To successfully achieve these goals, the continued cooperation and communication between the U.S. Department of Energy (DOE) and ADEC are critical. The Site Assessment and Remedial Action Plan establishes the project organization, responsibilities, and authority for the participating organizations.

1.6 Remediation Clean-Up Level

A risk analysis of the mound at the Project Chariot Site (Appendix C) was conducted to establish a remediation clean-up level for the project. The purpose of this clean-up level is to verify that the contaminated soils from the tracer studies have been removed from the mound site. After the physical removal efforts have been completed, verification samples will be taken (in accordance with the Sampling and Analysis Plan [SAP]) from the soils below where the mound was located. The results of these samples will be compared to the remediation clean-up level. Any material that exhibits contamination above the clean-up level will be removed. Additional verification sampling and removal will continue until all samples are below the clean-up level. This clean-up level will also be utilized to verify that fill dirt from the top portion of the mound is not contaminated.

Based on the exposure and risk analysis, a clean-up level of 0.4 becquerels per gram (Bq/g) (10 picocuries per gram [pCi/g]) for cesium-137 (Cs-137) will be used for the project. The derivation of this clean-up level is discussed in Appendix C.

1.7 Site Assessment and Remedial Action Plan Organization

The Site Assessment and Remedial Action Plan is organized into seventeen chapters, including this introduction. Chapter 2.0 presents the physical and environmental setting of the Project Chariot Site and its surroundings. The history and the current understanding of the Project Chariot Testing Program and the 1962 Tracer Study Project, along with the available data on radioisotopes utilized during the tracer study, are summarized. Areas of potential concern generated by the 1962 Tracer Study Project are reviewed in Chapter 3.0, and the focus of the Site Assessment and Remedial Action Plan is established.

Chapter 4.0 presents the project organization, responsibilities, and authority. The roles and authority of key project members/organizations, lines of communication, and responsibilities are established. A process to identify and resolve project issues is presented to maintain the continuity of the project and schedule. The IT Corporation (IT) project organization is described and a summary of its lead technical responsibilities is presented. In Chapter 4.0, the procedures to be implemented by IT in project documentation and reporting are summarized, along with a schedule and format for project meetings.

Health and Safety issues and requirements are presented in Chapter 5.0. The applicability of the Site-Specific Health and Safety Plan (SSHASP) and the responsibilities and authority of the on-site Health and Safety Officer are established.

Chapter 6.0 details the site operations that will be conducted during the remedial action. Requirements for security at the project site, as well as the methods and limitations of communication and responsibility for public and news media liaisons, are presented. A summary of the permit requirements and responsible organization(s) is also presented.

In Chapter 7.0, the mobilization process for equipment, labor, materials, and support services is detailed. The mobilization stages are described in a sequence that optimizes the schedule and provides a smooth transition from mobilization activities to remedial operations. Site preparation activities are presented in Chapter 8.0 and include container storage area preparation, delineation of project work zones, and work area preparation.

Chapter 9.0 presents the soil erosion and sediment control practices to be implemented during the remedial action prior to any major soil disturbance. The soil erosion and sediment control practices discussed include utilization of existing access routes for transportation; sand bags and a wooden crane mat will be used in Snowbank Creek to provide a stable surface for vehicles to traverse; a ditch will be excavated around the soil mound to divert storm water away from the mound; and site revegetation activities will occur at the site after the ADEC approves the clean closure of the site.

Chapter 10.0 summarizes the sampling and analysis procedures to be implemented for waste classification for disposal and transportation requirement needs. The procedures and methodology to perform the soil excavation are described in Chapter 11.0. Excavation techniques and procedures to be employed are detailed, along with the procedures to perform soil sampling and in-field analysis using on-site laboratory instrumentation. The method of container preparation and loading is presented. The procedures to be utilized to handle the loaded containers and to temporarily store the containers are described. Chapter 11.0 also highlights the equipment, support services, and contingencies required to perform the excavation plan. Chapter 12.0 describes the procedures for the collection and analysis of post-excavation samples and identifies the process for ADEC field approval of final closure.

The transport method and transportation logistics for the removal of the containerized soil from the Project Chariot Site to the final disposition facility are described in Chapter 13.0. Chapter 14.0 presents the location and disposal technology to be utilized for the disposal of the containerized soil generated by the remedial action.

The methodology to perform the radiological survey, biota sampling, and background sampling is presented in Chapter 15.0. The strategy for the surface water and sediment sampling is also described in this chapter.

In Chapter 16.0, the demobilization process for equipment, labor, materials, and support services is detailed. All stages of demobilization and subsequent site close-out inspection are described in Chapter 16.0. The contents of the Project Close-Out Report are described in Chapter 17.0. A project schedule is presented in Chapter 18.0, along with factors and issues that may potentially have adverse impacts on the schedule.

Appendices to this Site Assessment and Remedial Action Plan include supporting project plans that are necessary to manage, conduct, and control the remedial action project. The attached plans are:

- Appendix A: SAP, consisting of:
  - Part 1: Field Sampling Plan (FSP)
  - Part 2: Quality Assurance Project Plan (QAPjP)
  - Part 3: Standard Operating Procedures (SOP)
- Appendix B: SSHASP
- Appendix C: Risk Analysis for the Project Chariot Site.

1.8 Quality Assurance

This Site Assessment and Remedial Action Plan and its supporting project plans (i.e., the SAP, FSP, SOPs, QAPjP, and SSHASP) have been developed to meet specific guidelines for format and structure, within the overall quality assurance (QA) program structure mandated by the DOE/NV for all activities conducted under the Environmental Restoration Program. The hierarchy of QA program documents applicable to this project is as follows:

1. DOE 5700.6C Quality Assurance (Policy)
   NV 5700.6C Quality Assurance (Policy)
   NV57XB.1-11 Quality Assurance Manual

2. NV Environmental Restoration Program Quality Implementation Plan (QIP) Standards adopted: ANSI/ASME; NQA-1; EPA QAMS 005/83

3. *Quality Assurance Project Plan for the Project Chariot: 1962 Tracer Study Remedial Action Plan*

4. *IT Program Quality Assurance Plan,* Environmental Support Services Contract for U.S. Department of Energy Nevada Field Office Environmental Restoration Program, April 1992.

This page intentionally left blank

2.0 Site Background and Setting

2.1 Site Description

The Project Chariot Site is in the Cape Thompson region, north of the Arctic Circle in northwestern Alaska, between latitudes 66°45'N and 69°00'N (Figure 2-1). This region is bounded on the west by the Chukchi Sea and extends east to longitude 162°00'W. Its physiographic province distribution is 60 percent in the Arctic Foothills Province, 35 percent in the Arctic Mountains Province, and 5 percent in the Western Alaska Province. The principal population centers are Point Hope, Kivalina, Noatak, Kotzebue, and Lisburne.

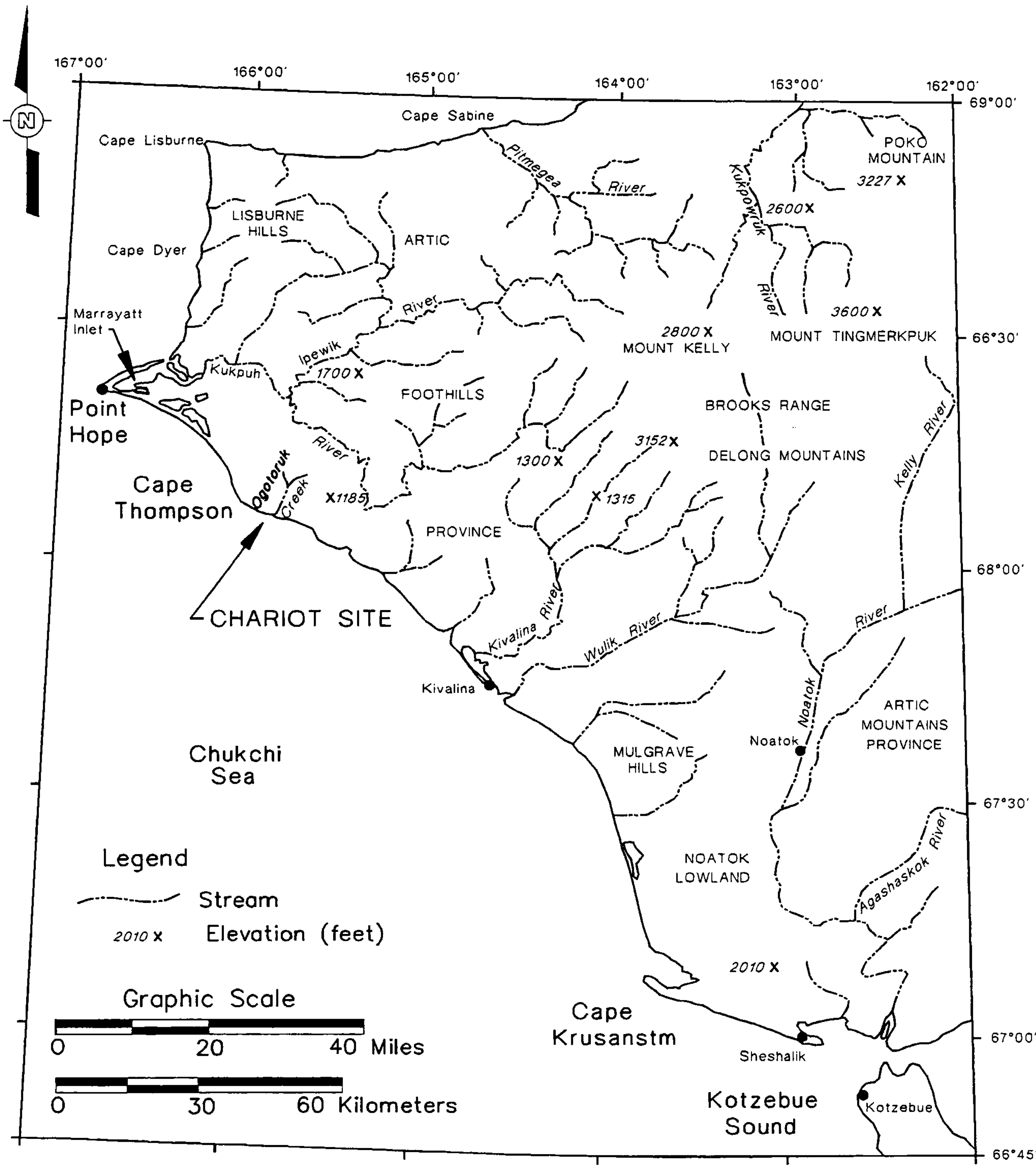
The Project Chariot Site is at the mouth of the Ogotoruk Creek, latitude 68°06'N and longitude 165°46'W (Figure 2-2). Extreme weather conditions limit access to the site in the winter. The Chukchi Sea is not deep enough to permit the safe operation of deep-draft ships within 1.6 km (1 mi) off-shore near the site.

The Project Chariot Site has three gravel airstrips: a 137-m (450-ft) strip with an azimuth heading of 190°, a 305-m (1,000-ft) strip with a heading of 305°, and a 670-m (2,200-ft) strip with a heading of 335°. The 137-m (450-ft) and 305-m (1,000-ft) landing strips are adjacent to the Chariot camp on the west bank of Ogotoruk Creek. The 670-m (2,200-ft) strip, at which larger aircraft can land and take off, is east of Ogotoruk Creek and about 900 m (3,000 ft) from camp. This runway is rutted. The eroded surface areas will be filled in with gravel located at the periphery of the runway. The runway will not be graded to ensure heat conduction does not damage the permafrost.

2.2 Project Chariot Testing Program History

Project Chariot was an experimental part of the U.S. Atomic Energy Commission's (AEC) Plowshare Program to test the use of nuclear explosives for peaceful purposes. In 1958, the commission authorized planning and studies for an experimental harbor excavation in Alaska using nuclear explosives. The primary purpose of this project was to investigate the technical problems and to begin development of a nuclear-excavation technology. At the same time, other studies were underway using nuclear explosives, including a test called Sedan, a cratering experiment carried out at the Nevada Test Site (NTS).

The AEC, with the assistance of other agencies, university researchers, and the Canadian Government, conducted pre-test environmental studies in the Cape Thompson Area to allow

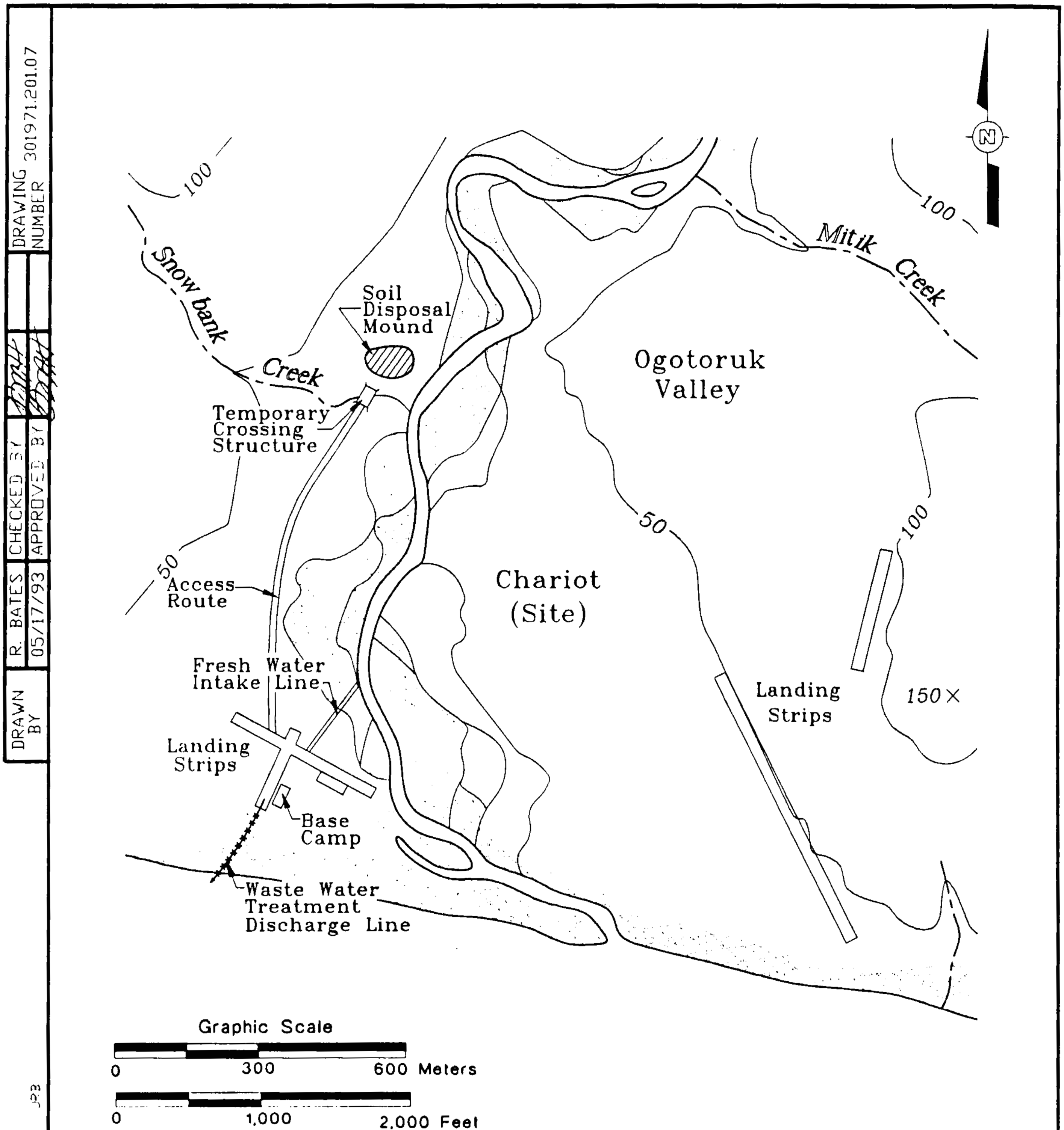


DRAWN BY R. HYNA 06/09/93 CHECKED BY APPROVED BY DRAWING NUMBER 301971.201.07

CHARA22 07/01/93 3:15PM JRB

FIGURE 2-1
CAPE THOMPSON
REGION

Source: Wilimovsky and Wolfe, 1966



Notes:

1. Access Route, Temporary Crossing Structure, and Soil Disposal Mound are not drawn to Scale
2. The Access Route represents an approximate location. The actual route will be the existing route, which can not be exactly identified from existing information.
3. The base camp, fresh water intake line, and waste water treatment discharge line represent approximate locations and are not to scale.

FIGURE 2-2
PROJECT CHARIOT SITE LOCATION

adequate assessment of the effect of the proposed project and to assure that it could be conducted safely. The commission conducted more than 40 separate environmental investigations, mainly between 1959 and 1961. By 1962, much of the desired nuclear-excavation engineering data originally planned to be obtained in Project Chariot had become available or would be available from experiments at other sites. The AEC decided in 1962 to suspend Project Chariot and to end the associated environmental studies. No nuclear devices were brought to the Project Chariot Site. Many of the environmental study results and site descriptions presented in this plan were published in 1966 in a book entitled *Environment Of the Cape Thompson Region, Alaska* (Wilimovsky and Wolfe, 1966).

During the course of these environmental studies, the USGS, under a license granted by the AEC's Division of Licensing and Regulation, carried out a five-day (August 20 to 25, 1962) radioactive tracer experiment on the soils at the Project Chariot Site. The purpose of this experiment was to measure overland transport of certain radioactive tracers at the site. Small quantities of radioactive tracer material and approximately 6.8 kilograms (kg) (15 pounds [lb]) of soil containing radioactive fallout from the Sedan cratering experiment in Nevada were used for the tests. These measurements were on 12 plots, which were specifically designed to represent a variety of microdrainage patterns, underground transport and sediment transport. All 12 soil test plots were close to the headwater forks of Snowbank Creek, about 2.6 km (1.6 mi) north-northwest from the base camp with the sediment transport site on Tributary No. 3 of Snowbank Creek. The test plots ranged in size from 0.6 by 0.6 m (2 by 2 ft) to 1.5 by 2.1 m (5 by 7 ft). The following types and activities of the radioisotopes were used:

Radioisotope	**Activity** (At the time of the test)
Cesium-137	2×10^8 becquerels (6 millicuries)
Iodine-131	2×10^8 becquerels (5 millicuries)
Strontium-85	2×10^8 becquerels (5 millicuries)
Project Sedan fallout	4×10^8 becquerels (10 millicuries)

The experimental technique involved the following steps:

1. Each of the plots was enclosed with 2.5 by 15-cm (1 by 6-in.) boards that were wrapped in polyethylene sheeting, set edgewise, and buried sufficiently deep to cut off both surface flow and shallow seepage through the soil.

2. A single tracer was distributed uniformly on each plot, generally over the entire plot, but only over one-third of plots 106 and 113. Two of the tracers, Cs-137 and Sr-85, had been

acquired in soluble form, dissolved in hydrochloric acid. In the USGS Denver laboratory, the radionuclide-bearing acid solution had been buffered and diluted with Na_2CO_3, (sodium carbonate) to a pH of about 5.6 and a concentration of about 0.05 normal, and exchanged onto a local sandy soil that contained very little organic matter. The soil was then oven dried prior to transport to the Chariot site. At the site, the soil containing the radiological tracers was further mixed with a tundra soil that had been dried and screened and that had fairly large exchange capacity and high organic matter content. The twice-mixed Cs-137 tracer was applied to plots in concentrations of about 4.4×10^3 to 8.9×10^3 becquerels per square centimeter (Bq/cm^2) (0.12 to 0.24 microcuries) per square centimeter [$\mu Ci/cm^2$]). Concentrations of the Sr-85 tracer were about 5.6×10^3 to 1.3×10^4 Bq/cm^2 (0.15 to 0.35 $\mu Ci/cm^2$).

A third tracer, I-131, was handled in much the same way except that mixing with the sandy soil at Denver was accomplished by wetting and drying rather than by exchange. The second-stage mixing at the Chariot site was with the same tundra soil as that used to mix the Cs and Sr tracers. The twice-mixed I-131 tracer was applied to plots 109 and 110 in concentrations of about 10×10^3 and 2×10^3 Bq/cm^2 (0.27 to 0.054 $\mu Ci/cm^2$), respectively.

The fourth and final tracer was comprised of about 6.8 kg (15 lb) of radioactively-contaminated soil collected about 1.6 km (1 mi) from ground zero of the Sedan detonation at the NTS. This tracer was from 45 to 50 days old at the time of these experiments. It comprised diverse fission and activation products, largely attached to particles of the NTS alluvium. It was not further mixed at the Chariot site. Of this fallout tracer, about 3×10^6 Bq (70 μCi) was applied to each of three plots (113, 114, and 115), resulting in concentrations from about 3.6×10^2 to 4.4×10^3 Bq/cm^2 (0.0097 to 0.12 $\mu Ci/cm^2$).

3. To simulate rainfall, water drawn from Snowbank Creek by a portable gasoline-powered pump was applied to the plots through a hose and spray nozzle. The test plots were located at a distance no greater than 20 m (60 ft) from the creek. Among the 12 plots, four received one such application, four received two applications each, and two received seven applications in succession. Each application was sufficient to transiently saturate the surface soil of the plot and to generate ephemeral runoff. The amount of simulated rain was measured in several gages (50-milliliter [mℓ] beakers); the range was between 0.64 and 4.95 cm (0.25 and 1.95 in.) per application and, in total, between 3.53 and 14.7 cm (1.39 and 5.78 in.) per test. Intensity of the simulated rainfall was substantially greater than would be expected to occur naturally.

4. Samples of the generated runoff were taken in 100-mℓ polyethylene bottles for transport to the laboratory at Denver to determine radioactivity. Also, samples of soil on several plots were taken to a depth of 1 cm (0.4 in.), for determinations of bulk density and radioactivity. On the plots to which simulated rain was applied more than once, runoff was intermittent and was regenerated by each application; each generation of runoff was sampled separately. Radioactivity due to Sr-85 and I-131 was determined by appropriate counting on 2-mℓ aliquots of runoff; that due to Cs-137 or to mixed products from Sedan fallout was first counted on 2-mℓ aliquots and later recounted on the residual samples.

In addition to the overland transport tracer study, underground transport of radionuclides was appraised by a simple 18-hour percolation test in August 1962 on a hillside above Snowbank Creek (plot 62 ABJ 116). A small pit was dug through a surface layer of humus-rich soil 15 cm (5.9 in.) thick, and about 10 cm (4 in.) into underlying silt and clay. The pit was filled to within 5 cm (2 in.) of its rim with 1.4 kg (3 lb) of Sedan soil mixed into a slurry with creek water. The pit was refilled three times with additional water. The resultant percolate was sampled in a trench dug 84 cm (33 in.) downslope from the pit. Samples were taken in 100-mℓ polyethylene bottles at 15-minute intervals during the first four hours and then once after 18 hours. At the end of the test, soil samples were taken from a subsidiary trench dug from the pit to the percolate trench. This test showed the attenuation of radionuclides adsorbed or exchanged from percolating or infiltrating water.

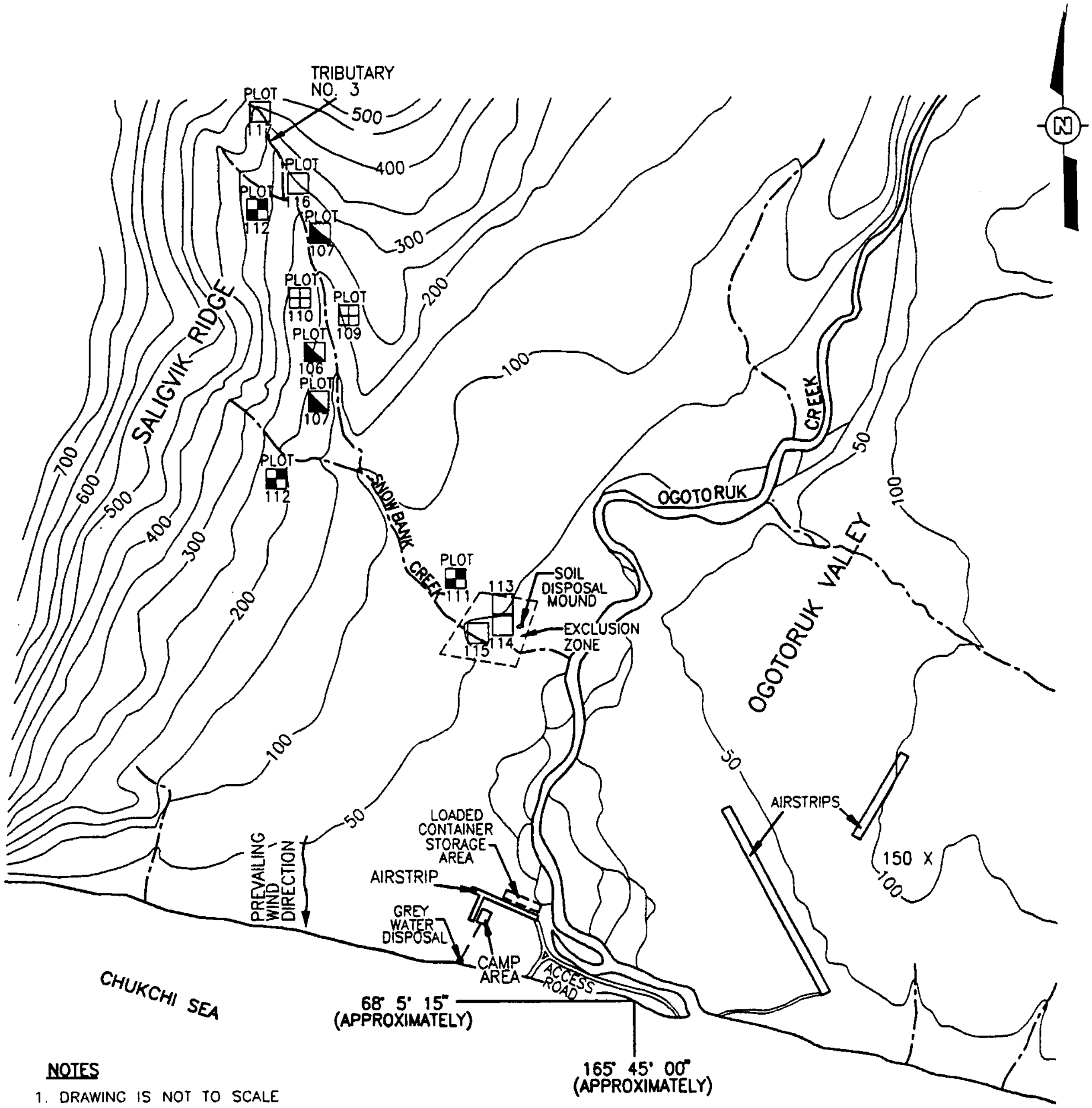
A sediment transport experiment was conducted on a small tributary of Snowbank Creek (Tributary No. 3), which was identified as test plot 117. The reach chosen was of fairly uniform slope. Tributary No. 3 flows into Snowbank Creek, which in turn flows into Ogotoruk Creek. Snowbank Creek has a fairly uniform slope (vertical drop of 15 m [50 ft] over a horizontal distance of approximately 646 m [2,120 ft]). Tributary No. 3 is approximately 0.3 m (1 ft) in width and had a flow rate of approximately 60 liters per minute (lpm) (16 gallons per minute [gpm]) and an average velocity of water flow of 0.1 meters per seconds (m/s) (18 feet per minute [fpm]). The flow rate was determined by catching the total discharge of the stream over a small waterfall in a bucket for measured lengths of time. The tributary was measured into 6-m (20-ft) reaches. Sample locations were located at 6-, 12-, and 18-m (20-, 40-, and 60-ft) stations downstream of the zero point (location where the test began). The zero point was approximately 12 to 15 m (40 to 50 ft) downstream of the headwaters of Tributary No. 3. A slurry containing approximately 2.47 kg (5.44 lb) of Sedan-event fallout soil was introduced as a single slug at the zero station of the test reach. The Sedan-event fallout soil, the tracer material used in the slurry slug, was fine-grained material collected 1.6 km (1 mi) from ground zero of the Sedan event. Simultaneous samples of water were collected at one-minute intervals in 1-ounce (oz) polyethylene bottles at the 6-, 12-, and 18-m (20-, 40-, and 60-ft) sampling points. Fifteen minutes after introduction of the Sedan soil slurry, the stream bottom at the point of introduction was vigorously agitated to dispense any of the slurry that may have been absorbed or settled on the stream bottom. Sampling was continued until a total time of 20 minutes had elapsed from the time of the initial introduction. All samples were transported to the USGS laboratory in Denver, Colorado.

At the USGS, count rates were recorded, and a histogram was drawn plotting counts per minute per milliliter (cpm/mℓ) versus time for each of the three different sampling stations. A curve was fitted from the histogram data, and the maximum count rate of the two concentration peaks at each of the three sampling stations was plotted as cpm/mℓ versus distance, in feet downstream from the point of introduction. The approximate locations of the test plots are illustrated on Figure 2-3.

Following completion of each test plot experiment and the percolation test, the soil was removed and transported to a waste disposal area in half-filled 55-gallon drums. Four to six half-filled drums of soil were collected for disposal. The waste soil was emptied and mixed with the in-situ site soils. The rationale behind the mixing of the soils was to disguise the isotopic ratios for security reasons. According to historical documents, this process generated approximately 45 m^3 (1,600 ft^3) of soil, 0.46 m (1.5 ft) thick over an area of approximately 12 by 12 m (40 by 40 ft). The 2.5 by 15-cm (1 by 6-in.) boards and polyethylene sheeting were also disposed with the soil. This soil was then covered by up to 1.2 m (4 ft) of clean soil. The average activity concentration of the radioactivity in the soil at the time of emplacement was approximately 9.6 Bq/g (0.26 nanocuries per gram [nCi/g]).

Both I-131 and Sr-85 have half-lives of less than 70 days. Therefore, both of these isotopes have essentially decayed away, leaving only the longer half-life Cs-137 (30 years) and Sedan fallout with half-lives of 3 years or greater. The present activity concentration of radioactivity in the soil is estimated to be 1.1 Bq/g (0.03 nCi/g), with a total of less than 1.1×10^8 Bq (3 mCi) for the entire mound. Based on the risk assessment review performed by Oak Ridge Institute for Science and Education (ORISE), neither the current level of radioactivity nor the activity present in 1962 poses a risk to human health or to the environment.

In accordance with the Health Intervention Plan for Point Hope, the Alaska Division of Public Health has reviewed all available health information and generated a report titled, *Health Risk Assessment of Radioisotopes at Cape Thompson, Alaska* (Wilimovsky and Wolfe, 1966), November 24, 1992. This report concluded that the radioisotopes at Cape Thompson present no health risk to subsistence hunters in the area or to persons living in nearby villages. Also, the report states that radioisotopes have never presented nor will they present a risk if left in the present state.



NOTES

1. DRAWING IS NOT TO SCALE
2. FIGURE ILLUSTRATES TENATIVE LOCATIONS OF BASE CAMP AND ASSOCIATED SUPPORT FACILITIES.

LEGEND

- SEDAN SOIL
- CESIUM – 137
- IODINE – 131
- STRONTIUM – 85
- 100 CONTOUR LINES – 50 FOOT INTERVALS
- CREEKS

REFERENCE: INFORMATION TAKEN FROM PLATE I, TOPOGRAPHIC MAP OF PART OF CAPE THOMPSON REGION, NORTHWESTERN ALASKA, DATED 1965.

FIGURE 2–3
TENATIVE TEST PLOT LOCATIONS

DRAWN BY R. BATES 06/28/93 | CHECKED BY | APPROVED BY | DRAWING NUMBER 301971.201.07

CH4RA30 07/01/93 6:00PM JRB

On April 28, 1963, the site of the Chariot test was transferred to the Naval Arctic Research Laboratory (NARL). The buildings, airstrip, and the structural improvements placed at this site were used by the U.S. Navy, and additional structures were built. The NARL ceased operations at the site in 1970, and the site was transferred to the Bureau of Land Management (BLM). The site was later transferred to the U.S. Fish and Wildlife Service (USFWS) in 1980, with the exception of two individual Native Allotments. When the U.S. Army Corps of Engineers performed the initial field investigation at the Project Chariot Site, areas of potential environmental concern were identified and included debris, structures, and waste materials. Based on these findings, the site was identified as a potential Defense Environmental Restoration Program for Formerly Used Defense Sites (DERP-FUDS). The location was verified through real estate records maintained at the U.S. Army Engineer District, Alaska. The Department of Defense (DoD) approved this site under the DERP-FUDS program on August 8, 1988. A Remedial Action contract was awarded in fiscal year (FY) 1990 for the clean-up of debris, buildings, petroleum containers, and contaminated soils. The Remedial Action was performed and completed during the summer of 1992.

Recently, a researcher at the University of Alaska at Fairbanks obtained two letters under the Freedom of Information Act (FOIA), written in the early 1960s from the USGS to the AEC. These two pieces of correspondence focused on the use of radioactive isotopes at this site during the performance of the investigations associated with the AEC's Project Chariot during the early 1960s. The letter also addressed the isotope materials buried at the site at the conclusion of the experiment.

In response to concerns raised through the publication of this information by the news media and heightened local political interest facilitated by public concern, ADEC and the U.S. Corps of Engineers conducted a site investigation on September 10-14, 1992. The surface radioactivity survey indicated no readings above background levels. No visible signs of stressed vegetation were observed. A hole was hand-augured diagonally into the southwest surface of the mound. Readings were not distinguishable above background until a depth of approximately 1.1 m (3.5 ft), where a reading 0.1 milliroentgen per hour (mR/hr) was recorded. However, based on a DOE review of the video tape of this event, the results should be used for qualitative information due to the sampling methodology employed.

On October 21, 1992, representatives from the DOE/NV, IT Corporation, ADEC, Point Hope, and Barrow residents performed a site inspection. The objectives of the site inspection were to assess the soil disposal mound to perform a radiation survey of the mound surface, to inspect and assess logistically important facilities at the site (airfields), and to inspect the buildings at the site for potential use. No readings registered above background at the surface of the soil disposal mound using a gamma scintillation counter, an alpha scintillation probe, and a beta/gamma Geiger-Mueller pancake probe.

On June 22, 1993, representatives from DOE, ADEC, USFWS, and IT Corporation performed a site reconnaissance. They were accompanied by Mr. Walter Russell who acted on behalf of Mr. Wilfred Lane, the allotment holder for the land.

The objectives of the site reconnaissance were to:

- observe site conditions after snowmelt
- measure the mound and the runways
- inspect the terrain and any disturbed areas
- assess the access from the camp to the mound
- assess soil conditions around the mound
- identify the former tracer plot locations
- assess conditions for biota sampling
- document the condition of the site before site assessment and remedial action begins, including buildings, vehicles, spills, drums and disturbed areas.

All the objectives of the site reconnaissance were met.

Based upon all available information, the DOE's position is that the soil disposal mound has never presented nor will it ever present a hazard to the public or the environment. Upon evaluation of potential costs for further investigations at the site and complicated logistical issues, the DOE determined that the implementation of a remedial action was the most cost-effective approach.

2.3 Physical Setting

The Project Chariot Site is located in the southern end of the Ogotoruk Valley. Permafrost is found throughout the area which regulates groundwater flow. This valley receives less precipitation and lower temperatures than the surrounding areas.

2.3.1 Topography

The Ogotoruk Creek occupies the southwest trending Ogotoruk Valley, which is 10.5 km (6.5 mi) long and 3 to 5 km (2 to 3 mi) wide. The valley floor rises from a few feet above mean sea level (msl) at the coast to about 84 m (275 ft) above msl at a poorly defined divide that separates it from the Saligvik Valley. Pumaknak Pond, Ikaknad Pond, and other ponds on the divide drain both south into Ogotoruk Creek and north into tributaries of the Kukpuk River. The west side of the Ogotoruk Valley is steeper than the east. The Ogotoruk Creek is generally less than 3 m (10 ft) below the valley floor, but where it flows down the sides of the valley to the floor, it is incised locally as much as 4.6 m (15 ft).

Topographic highs rising from the valley floor are bedrock knobs consisting of mudstone. The low-lying areas are swampy, the gentle slopes are mantled by colluvium, and the steeper slopes are covered by talus. On the west slope of the valley, solifluction lobes are common above an elevation of 60 m (200 ft) above msl. Large areas of polygonal ground have formed in windblown sand and silt deposits.

2.3.2 Geology

The Chariot site is underlain by frozen mudstone of the Ogotoruk Formation of Jurassic or Cretaceous Age. The mudstone is mantled by unconsolidated deposits of Quaternary Age that consist of ancient beach deposits, terrace deposits, colluvium, flood plain deposits, alluvial fan deposits, swamp deposits, silt deposits, and terrace deposits. Although the unconsolidated debris is locally as much as 9 m (30 ft) thick, it generally is only a thin veneer ranging from 1.5 to 3.7 m (5 to 12 ft) thick.

The Chariot site is underlain by permafrost extending from within 0.3 m (1 ft) of the surface to depths of about 351 m (1,150 ft) inland and 288 m (945 ft) near the coastline. Ice wedges and lenses are extensive in the unconsolidated deposits. A peat layer, which is over 0.3 m (1 ft) thick in some places covers most of the valley, is an excellent insulator and has maintained the permafrost at shallow levels.

2.3.3 Hydrology

Groundwater in areas surrounding the Project Chariot Site occur in two distinct environments: shallow aquifers associated with stream flood plains and deep aquifers associated with major fault systems in the limestone and dolomitic rocks. Local surface water drains into the Ogotoruk Creek which flows into the Chukchi Sea.

2.3.3.1 Shallow Aquifers

Previous geologic investigations indicate that, except for the stream flood plains and terraces, only a thin mantle of weathered material overlies the bedrock. Perennially frozen ground prevents water-bearing zones from occurring in this thin mantle. Relatively thick beach deposits from a higher stand of the sea are also perennially frozen, except where streams dissect them and occasionally thaw adjacent portions. The shallow aquifers are, therefore, only present adjacent to the major streams.

The lower reach of Ogotoruk Creek flows in a moderately broad valley that has a bedrock floor covered by a thin layer of unconsolidated material. The flood plain aquifer is a water-table aquifer, and recharge is directly related to streamflow and precipitation. In spring, meltwater usually floods the plain and recharges the porous deposits. Rainfall also contributes to recharge once the seasonal frost has been thawed. If it is not already saturated, the coarse aquifer readily absorbs the rainfall.

Ogotoruk Creek usually maintains a thin year-round aquifer, provided that (1) late autumn rains provide a high creek stage, which creates full bank storage of groundwater; (2) severe freezing does not set in early; and (3) a thick snow cover develops over the aquifer and stream to slow the penetration of frost.

2.3.3.2 Deep Aquifers

Deep aquifers may occur within consolidated rocks either below or within the zone of permafrost. Beneath Ogotoruk Valley, the bedrock is primarily mudstone to a depth of at least 366 m (1,202 ft). Limestone, chert, and sandstone occur principally west of Ogotoruk Creek.

Aquifers may be present in the unfrozen permeable portions of the limestone and sandstone, particularly along fracture and fault systems. Arctic bedrock aquifers are believed to be recharged only where streams flow across the strike of the beds, such as along the east-trending course of the Kukpuk River about 16 km (10 mi) north of the Project Chariot Site. Recharge directly by precipitation appears to occur only locally because of the perennially frozen ground.

2.3.3.3 Surface Water

Ogotoruk Creek flows into the Chukchi Sea about 10 km (6 mi) southeast of Cape Thompson and about 51 km (32 mi) southeast of Point Hope. The creek is approximately 16 km (10 mi) long; it flows westward for the first 10 km (6 mi) and southward for the remaining 6 km (4 mi).

The drainage area of the upper reach 1.9 km (1.2 mi) upstream of the mouth of Ogotoruk Creek is approximately 98 square kilometers (km^2) (38 square miles [mi^2]). The drainage area of the lower reach of the creek is a broad valley, but the remainder is a rolling to hilly area with hills as high as 200 m (600 ft) above msl in crest altitude. The stream-bed altitude of the upper reach rises from about 6 m (20 ft) above msl at a point 1.9 km (1.2 mi) upstream from the mouth to about 60 m (200 ft) above msl 6.4 km (4 mi) upstream. With its fairly well-developed tributaries, the fan-shaped basin provides an efficient drainage system. The stream bed consists of highly permeable fine gravel, and the channel is braided throughout most of its length. The flood plain is about 300 m (1,000 ft) wide and is underlain by gravel, sandstone, and mudstone. Except for the flood plain, most of the drainage is covered by a protective mat of vegetation, which is underlain by permafrost.

2.3.4 Meteorology

The unique topographic features of Ogotoruk Valley channel cold air from the northeast around the western end of the Brooks Range, resulting in depressed precipitation totals and lower temperatures. This cold-air channeling, coupled with frequent northerly winter gales prevent heavy snow accumulation.

Most noticeable in northwestern Alaska are the high-velocity surface winds. The winds of greatest velocity, both on average and in the number reaching sustained gale force, occur in the coldest months of the year. The wind speed for Ogotoruk Valley in July and August range from 12.0 to 14.9 knots (13.8 to 17.1 miles per hour [mph]), respectively. The most frequent wind direction in Ogotoruk Valley is from the north, northeast.

The average precipitation in Ogotoruk Valley for the months of July and August ranges from 2.87 to 6.12 cm (1.13 to 2.41 in.). Temperatures in the Ogotoruk Valley range from 4 to 13 degrees Celsius (°C) (40 to 56 Farenheit [°F]) in July and 4 to 13°C (40 to 55°F) in August. The July-August monthly average percentage of sky cover from sunrise to sunset ranges from 58-91 percent to 68-82 percent, respectively. Sunlight ranges from approximately 24 hours in July to about 22 hours in August.

This page intentionally left blank

3.0 Areas of Potential Concern

During the course of the Project Chariot environmental studies, the USGS, under a license granted by AEC's Division of Licensing and Regulation, carried out a five-day (August 20 to 25, 1962) radioactive tracer experiment on the soils at the Project Chariot Site. The purpose of this experiment was to measure overland transport of certain radioactive tracers at the site. These measurements were performed on 12 plots that were designed to represent a variety of microdrainage patterns; all 12 test plots were adjacent to the headwater forks of Snowbank Creek. In addition to the overland transport tests, a percolation test was performed on a hillside above Snowbank Creek, and a sediment transport experiment was conducted in a tributary of Snowbank Creek.

Following completion of each test plot experiment and the percolation test, the affected soil was removed and transported to a disposal area (soil disposal mound). According to the records of the tracer study (and percolation test) and interviews with personnel involved in the actual tests, all affected soil was removed from all of the test plots and the trench and transported to the soil disposal mound. Nevertheless, three areas of potential environmental concern are considered at the Project Chariot Site:

- Soil disposal mound
- Tracer study plots and percolation trench
- Snowbank Creek sediments and surface water.

The sampling and analysis strategies presented in this Site Assessment and Remedial Action Plan have been developed based on the detailed process knowledge of the types of radioisotopes, and their associated activities utilized in the tracer study; historical documents prepared on the study; and in-depth interviews conducted by the DOE with the individuals who performed the study at the site.

This page intentionally left blank

4.0 Project Organization, Responsibilities, and Authority

4.1 Project Organization, Responsibilities, and Authority

The successful implementation of the Site Assessment and Remedial Action is dependent upon the establishment of a project management organization and the adherence to the defined roles and responsibilities within this organization. The project organization is illustrated in Figure 4-1. This organization is essentially a hierarchical structure that clearly defines lines of responsibility and authority with central project authority allocated to the DOE/NV Project Manager.

4.1.1 Department of Energy/Headquarters Project Director

The U.S. Department of Energy Headquarters (DOE/HQ) Project Director, or designated alternate, is responsible for project oversight to ensure that all activities are performed in accordance with the ADEC-approved Site Assessment and Remedial Action Plan and with DOE Orders. The DOE/HQ Project Director, or designated alternate, will serve as the sole point of contact for the project with the local populace, and news media. This responsibility has been assigned to:

Mr. Thomas M. Gerusky
U.S. Department of Energy
Division of Southwestern Area Programs (EM-452)
Office of Environmental Restoration
Washington, D.C. 20585

The DOE/HQ Project Director will monitor site operations and support the DOE/NV Project Manager in the resolution of regulatory and programmatic issues.

4.1.2 Department of Energy/Nevada Operations Office Project Manager

The DOE/NV Project Manager, or designated alternate, will serve as the primary point of contact for all activities to be conducted under this Site Assessment and Remedial Action Plan. The DOE/NV Project Manager is responsible for ensuring that activities conducted during the remedial

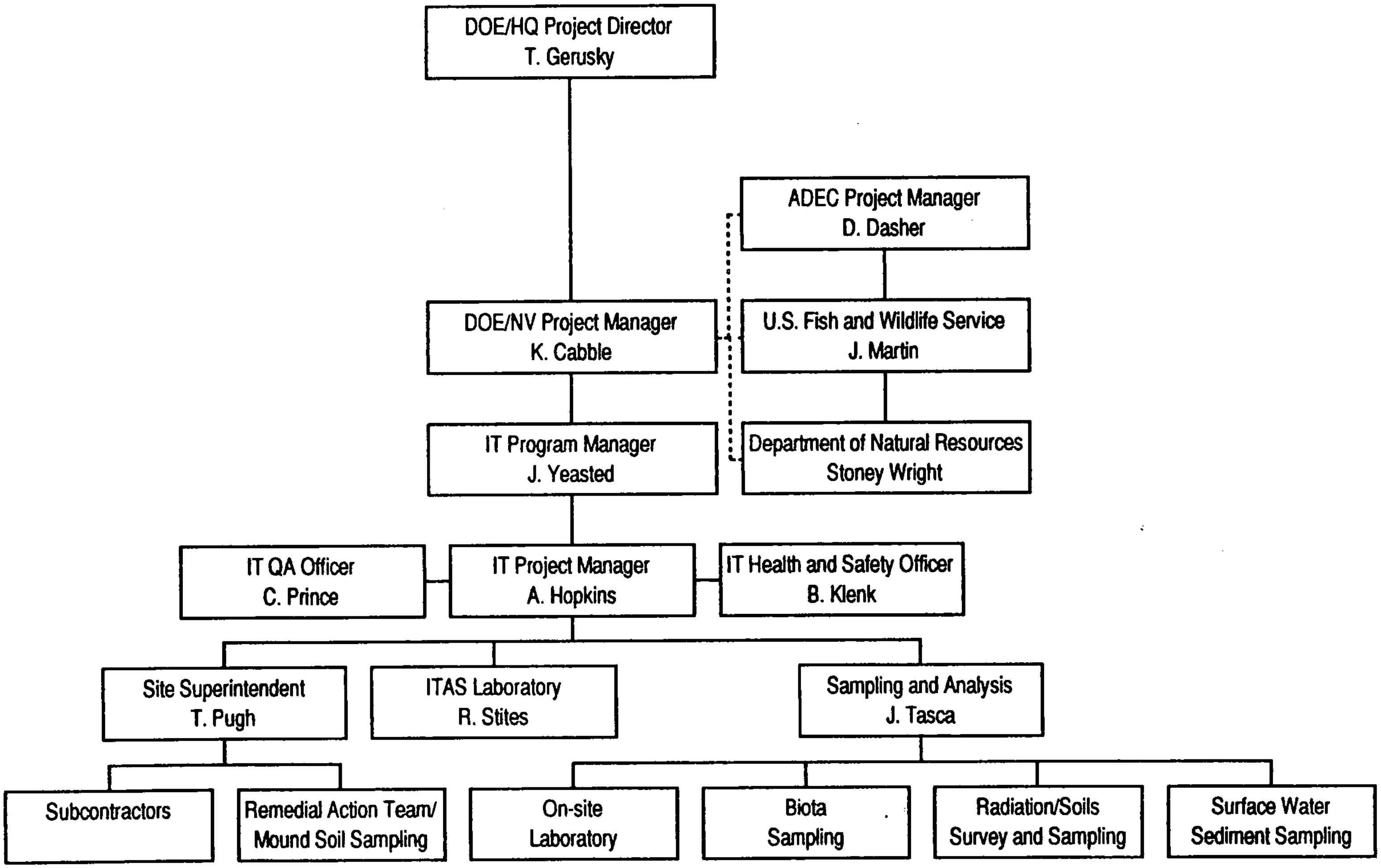


Figure 4-1
Project Chariot Remedial Action Organization Chart

action at the Project Chariot Site fulfill the obligations of DOE/NV, as described in the ADEC Grant and the approved Site Assessment and Remedial Action Plan. This responsibility has been assigned to

Mr. Kevin J. Cabble
DOE Nevada Operations Office
Environmental Restoration Division
Post Office Box 98518
Las Vegas, Nevada 89193-8518

The DOE/NV Project Manager will plan, authorize, and control project work so that activities are completed in accordance with the Site Assessment and Remedial Action Plan on schedule and within budget.

All project issues identified by the participating organizations are to be brought to the immediate attention of the DOE/NV Project Manager, who, in consultation with the DOE/HQ Project Director, will solicit the necessary input from the appropriate organization(s) and initiate the Issue Identification and Resolution Process described in Section 4.3. The DOE/NV Project Manager has the sole authority to approve changes in the remedial action scope of work.

4.1.3 Alaska Department of Environmental Conservation Project Manager

The ADEC Project Manager, or designated alternate, is responsible for ensuring that the State's responsibilities, as defined by the Grant, are fulfilled. The ADEC Project Manager, or designated ADEC representative, is responsible for oversight activities and for monitoring the remedial action to verify compliance with the ADEC-approved Site Assessment and Remedial Action Plan.

This responsibility has been assigned by the ADEC to:

Mr. Douglas Dasher
Alaska Department of Environmental Conservation
Northern Regional Office
1001 Noble Street, Suite 350
Fairbanks, Alaska 99701-4980

Issues identified by the ADEC during site activities will be brought to the immediate attention of the DOE/NV Project Manager for resolution and/or clarification, in accordance with the Issue Identification and Resolution Process described in Section 4.3.

The ADEC Project Manager, or designated ADEC representative, will have the authority to evaluate postexcavation sampling analysis data and approve the final closure of the mound area. Due to logistical constraints, the approval process will occur in the field.

4.1.4 U.S. Fish and Wildlife Service

The U.S. Fish and Wildlife Service (USFWS) designated representative is responsible for oversight of activities that may impact the land over which USFWS has fiduciary responsibility.

4.1.5 Department of Natural Resources

The Department of Natural Resources designated representative is responsible for verifying that disturbed areas are revegetated by approved methods.

4.1.6 IT Project Manager

The IT Project Manager, will be the IT technical operations manager for the site assessment and remedial action. The IT Project Manager will have primary responsibility for project plan development and on-site management of the remedial action implementation. The remedial action project will be managed in accordance with DOE Requirements and Orders and the IT Program Management Plan. This responsibility has been assigned to:

Ms. Andrea M. Hopkins, CHMM, CEM
IT Corporation
4330 South Valley View, Suite 114
Las Vegas, Nevada 89103-4047

The IT Project Manager will represent IT's central technical authority for the project and will have full responsibility for project performance and responsiveness to DOE requirements. She will report directly to the DOE/NV Project Manager daily with status reports to ensure that project needs and scope are understood and addressed. The IT Project Manager will direct all on-site activities in accordance with the DOE approved Site Assessment and Remedial Action Plan.

The IT Project Manager will establish project policies in consultation with the DOE/NV Project Manager; monitor schedule and cost; coordinate reporting; ensure necessary resources, equipment, and materials are available; identify and resolve potential problems and conflicts in consultation with the DOE/NV Project Manager; ensure the health and safety of all project personnel; and ensure that quality work is maintained.

4.2 IT Project Management Organization and Responsibilities

IT's proposed project organization is essentially a matrix structure, with central project authority vested in the IT Project Manager.

4.2.1 IT Program Manager

The IT Program Manager is responsible for the overall compliance and management of IT's contract in accordance with DOE Orders, policies, and procedures. The Program Manager has been delegated corporate authority to ensure that the project is staffed with the required technical personnel. This responsibility has been assigned to:

Joseph G. Yeasted, Ph.D., P.E.
IT Corporation
4330 South Valley View Blvd., Suite 114
Las Vegas, Nevada 89103-4047

4.2.2 IT Project Manager

The IT Project Manager will be the key operations manager for the Site Assessment and Remedial Action execution and will have primary responsibility for project plan development and the implementation of the corrective action. The remedial action will be managed in accordance with established DOE Techniques and Orders and the IT Program Management Plan.

The IT Project Manager is

Ms. Andrea M. Hopkins, CHMM, CEM
IT Corporation
4330 South Valley View Blvd., Suite 114
Las Vegas, Nevada 89103-4047

The Project Manager will represent IT's central authority for the project and will have full responsibility for project performance and responsiveness to DOE requirements. She will interact directly with the DOE/NV Project Manager to ensure that project needs and scope of work are understood and addressed. The Project Manager will establish project policies in consultation with the DOE/NV project manager; monitor project schedule and costs; coordinate reporting; ensure the health and safety of project personnel; and ensure that the quality of work is maintained and performed in accordance with the DOE-approved Site Assessment and Remedial Action Plan.

4.2.3 IT Project Superintendent

The IT Project Superintendent for the remedial action is

Mr. Thomas Pugh
IT Corporation
2790 Mosside Blvd.
Monroeville, Pennsylvania 15146-2792

The Project Superintendent will report directly to the IT Project Manager and is responsible for:

- Develop and implement plans and specifications for the remedial action
- Directly supervising technical staff and subcontractors in the performance of remedial activities, in accordance with the ADEC-approved Site Assessment and Remedial Action Plan
- Maintaining all schedule commitments
- Developing and reviewing work products
- Acting as designated alternate for the project manager.

4.2.4 IT Contract Administrator

The IT Contract Administrator is responsible for the completeness and legal correctness of all subcontracts. The Contract Administrator will monitor contract funding, billing, and procurement to ensure all terms and conditions of the contract are adhered to. The IT Contract Administrator is

Ms. Sheila G. Hytla
IT Corporation
4330 South Valley View Blvd., Suite 114
Las Vegas, Nevada 89103-4047

4.2.5 IT Quality Assurance Officer

The IT Quality Assurance Officer (QAO) will serve as IT's organizational contact for all QA matters.

The IT Quality Assurance Officer is

Ms. Cheryl D. Prince, CQA
IT Corporation
4330 South Valley View Blvd., Suite 114
Las Vegas, Nevada 89103-4047

The QAO or designated alternate is responsible for developing and implementing the Quality Assurance Project Plan (QAPjP); serving as IT's on-site organizational contact for all QA matters, preparing and submitting all QA reports to the appropriate line managers, assuring that appropriate corrective actions are taken on all QA issues, conducting surveillances of field activities ensuring that data of known quality and integrity are available for each planning and reporting phase. The QAO will also act as the Waste Certification officer during the remediation of the mound soil. The QAO will ensure all elements required for waste acceptance by the NTS are met.

4.2.6 IT Project Health and Safety Officer

The IT Health and Safety Officer (HSO) has corporate oversight responsibilities for the project health and safety program. The HSO is

Mr. Brian G. Klenk, CIH
IT Corporation
4330 South Valley View Blvd., Suite 114
Las Vegas, Nevada 89103-4047

The HSO is responsible to the Project Manager for:

- Developing and implementing the project Health and Safety Plan
- Ensuring the health and safety of workers and the general public during project operations
- Conducting surveillance's and/or audits of field activities (or designated alternate)
- Developing health and safety standards
- Implementing personnel monitoring
- Establishing personnel training requirements
- Reporting project health and safety concerns to the IT Project Manager.

4.2.7 IT Analytical Services Laboratory Manager

The IT Analytical Services (ITAS) Laboratory Manager is responsible for lab analysis of soil, surface water, and sediments for gross alpha, gross beta and gamma analysis. The lab manager is responsible for ensuring that the Lab QA Program is implemented. This responsibility is assigned to:

Mr. Ron Stites, Laboratory Directory
IT Corporation
13715 N. Rider Trail
Earth City, Missouri 63045-1205

4.2.8 Sampling and Analysis Supervisor

The Sampling and Analysis Supervisor is responsible for all sampling and analysis tasks on-site. This includes delaying the biota, soils, sediment and surface water sampling teams, ensuring all off-site samples are properly shipped to the ITAS, ensuring all laboratory and field sampling procedures are followed and reporting any field discrepancies promptly to the Project Manager. This responsibility is assigned to:

Mr. Jeff Tasca
IT Corporation
165 Field Crest Ave
Edison, New Jersey 08837

4.3 Issue Identification and Resolution Process

The Project Chariot Site presents unique logistic issues for the performance of the site assessment and remedial action. Due to the remoteness of the site and the difficulty in communication with off-site organizations, the lead representatives of the DOE/HQ, DOE/NV, ADEC, and IT must delegate necessary authority to make binding, logic-based, field decisions during the performance of the project. The Site Assessment and Remedial Action Plan has been developed as a "working" document, based on a logical decision matrix that will enable project organizations and personnel to perform in accordance with governing regulations and guidelines. This section of the Plan describes a process for issue identification and resolution so as to maintain the continuity of the project and schedule without adversely impacting the quality of work.

The objectives of the issue identification and resolution process are to:

- Establish clear lines of communication between all organizations
- Obtain necessary input from all organizations on issues
- Enable a decision to be rendered that considers all applicable factors and consequences
- Establish a procedure to make in-field decisions in an expedited manner.

The logic flow process that will be employed is illustrated in Figure 4-2. All project issues identified by the participating organizations are to be brought to the immediate attention of the DOE/NV Project Manager. The issue will be evaluated by the DOE/NV Project Manager, in consultation with the DOE/HQ Project Director, and subsequently in consultation with the lead personnel from the participating organizations. Based on the evaluation, the issue will be classified as either:

- Operational
- Regulatory
- Scope of Work.

In an expedited manner, the DOE/NV Project Manager will meet with appropriate organization(s) to establish a resolution. Operational and scope of work issue resolutions will be evaluated to determine if regulatory input is required. Resolutions that require regulatory input will be presented by the DOE/NV Project Manager to the ADEC representative and USFWS representative for concurrence. Final resolutions will be promptly documented in writing and implemented by the responsible organization. Only in extenuating circumstances, and as the last option, will issues be brought to the attention of upper-level management within the organizations. This option should only be pursued if the issue resolution is out of the authority vested in each organizational representative. Due to the remote location of the Project Chariot Site and the difficulty in communications, the execution of this option would likely adversely impact the project schedule.

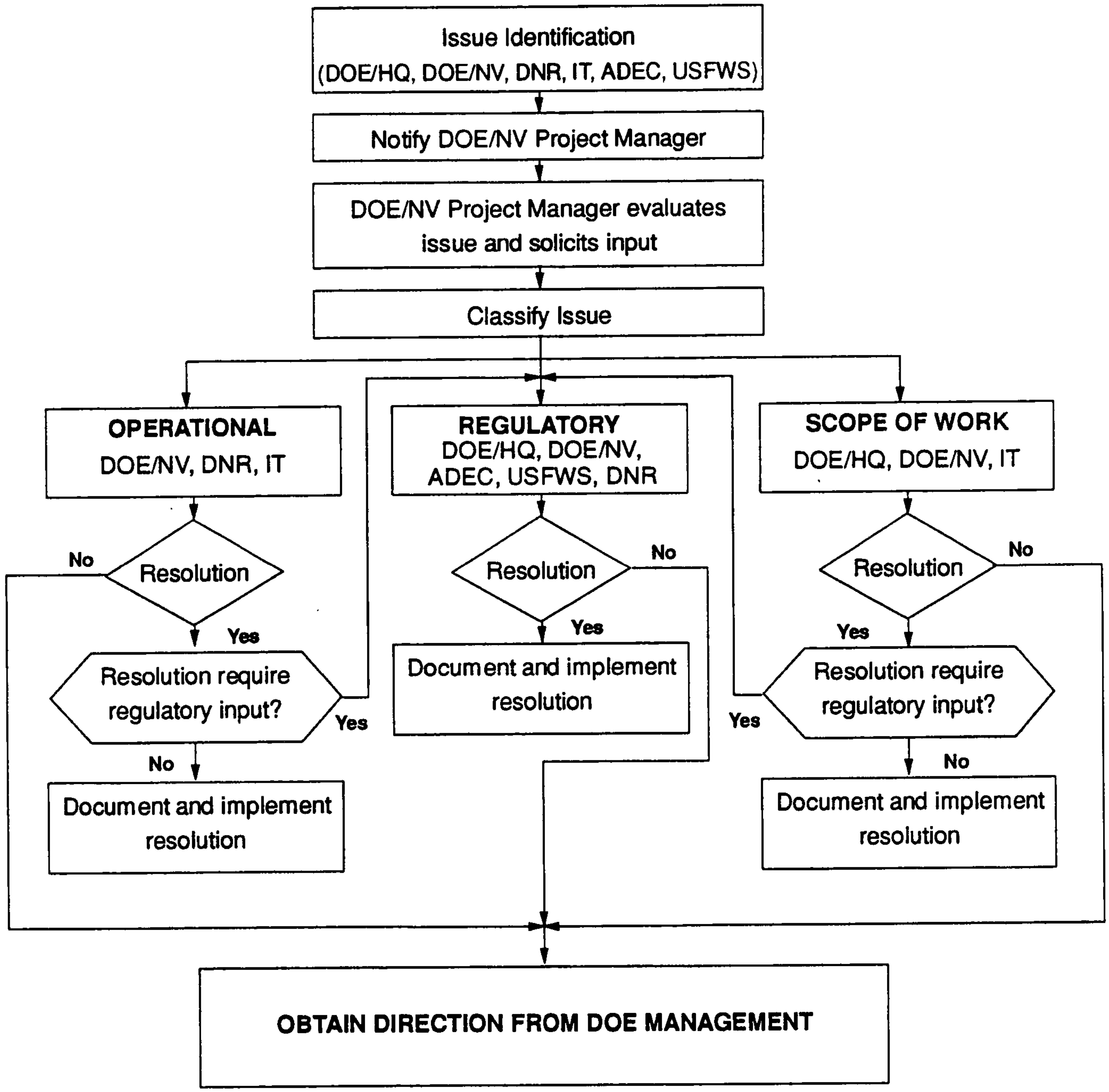


Figure 4-2
Issue Identification and Resolution Process Logic Diagram

4.4 Photodocumentation and Reporting

IT will document the remedial action at the Project Chariot Site through photographs and video tape. Preliminary photographs and video tape of the site will be taken prior to the commencement of work, as directed by the DOE/NV Project Manager. Subsequent photographs and video tape will be taken during the remediation phases. At a minimum and in accordance with the QAPjP, the following information will be indelibly printed on the back of each photo:

- Project Name
- IT Project Number and Photographers Name
- Date
- DOE/NV Witness
- View and Description.

When the DOE/NV directs the video taping of the remedial action, the video camera will be equipped with an automatic dating capability to document the date of each video event.

The project team will establish and maintain an on-site records file for the remedial action. All project- generated documentation, as required in the QAPjP and SSHASP, will be maintained on site for the duration of the field effort.

The IT Project Manager will document site activities and maintain an on-site Project Log for the duration of the Project Chariot: 1962 Tracer Study Site Assessment and Remedial Action. The Project Log will be a bound document with sequentially numbered pages. At a minimum and in accordance with the QAPjP requirements, the Project Log will document the following but not limited to:

- Date
- Weather
- All site personnel
- Visitors to the site
- Equipment on site
- Description of the day's activities
- Quantities of materials utilized
- Quantities and progress of work
- Significant occurrences
- Issue identification and resolutions
- Problems and recommended corrective actions

- Site security issues and resolutions
- Health and safety issues and resolutions.

IT will issue Daily Progress Reports to the DOE/NV Project Manager. The Daily Report will summarize the day's activities, problems and corrective actions, quantity estimates for each activity performed for the day, and estimated quantities to date. The Daily Report will present and discuss pertinent information on the schedule, and if appropriate, corrective actions necessary to maintain the project schedule. Reports are to be submitted to the DOE/NV Project Manager at the daily work meeting.

4.5 Project Meetings

Project meetings will be conducted daily prior to the Tailgate Safety meeting. The purpose of these meetings will be to establish the day's work objectives and to discuss any potential issues and resolutions. Attendance at the meeting will be mandatory for the following on-site personnel:

- DOE/NV Project Manager
- DOE/HQ Project Director
- IT Project Manager
- IT HSO
- IT Project Superintendent
- IT QAO.

Attendance by the ADEC Project Manager and USFWS representative or designee is requested to facilitate any resolution that may require regulatory input. These meetings are anticipated to be of short duration and to focus solely on operational issues. The meetings are essential to facilitating the Teamwork Attitude within the project organization and will enable the lines of communication to be maintained. The DOE/NV Project Manager will conduct the meetings, IT will assist and document the meeting minutes in the Project Log.

5.0 Health and Safety

5.1 Site-Specific Health and Safety Plan

A SSHASP has been developed for the Project Chariot: 1962 Tracer Study Site Assessment and Remedial Action and is presented as Appendix B. Due to the type of operations to be performed at the site and the potentially severe environmental conditions that may occur during operations, the SSHASP requirements represent a critical determinant of all on-site activities. Personnel from all organizations will be required to adhere strictly to the SSHASP requirements. Repeated nonconformance with these requirements will necessitate the removal of the offending individual from the site.

5.2 Health and Safety Officer Responsibilities and Authority

The on-site IT HSO is responsible for the implementation of the SSHASP and for ensuring the health and safety of on-site personnel during project operations. The HSO will conduct site-specific health and safety training for on-site personnel prior to the commencement of site activities and will conduct daily tailgate safety meetings, in accordance with the SSHASP. The HSO is responsible for reporting project health and safety concerns/issues to the IT Project Manager and for developing joint resolutions to the issues.

It is IT policy that all work is to be performed in a manner that protects all on-site personnel. The requirements presented in the SSHASP for on-site personnel safety will take precedence over the schedule. The HSO has the authority to stop on-site activities if, in his opinion, the activities are being conducted in a manner that endangers on-site personnel and/or if weather conditions pose a health and safety risk. Any stop-work order issued will be reported at once to the IT and DOE/NV Project Managers. The order will be addressed and conditions necessary to resume work will be determined. Corrective action will be implemented as soon as all conditions of the corrective action plan are met.

This page intentionally left blank

6.0 Site Operations

6.1 Security

The general security of activities within the periphery of the site will be under the control of DOE/NV and IT. Prior to mobilizing to the site, all participating organizations will be required to notify the DOE/NV Project Manager of the individuals who will operate at the site during the remedial action. Training and medical monitoring records of these individuals will be required to be submitted to IT, in accordance with the project SSHASP, prior to their mobilization to the site. Due to the logistical constraints and the limitations of on-site support services, each organization will be limited to a pre-determined number of on-site personnel. All personnel from either the participating organizations or others (local government representatives, news media) will be required to secure pre-approval and schedule of visits from the DOE/HQ Project Director and the DOE/NV Project Manager, and their stay at the site will be limited to one day. Overnight accommodations will only be provided with advance reservations on a space available basis, except for emergencies. The IT Office Manager will schedule visitors in consultation with DOE.

Visitors will be required to sign a form relieving the U.S. Government, its officers, employees, and IT of the liability or consequences related to potential hazards associated with travel to and from the site and associated with site entry. All visitors will be required to sign in and out of the site, and IT will maintain a log of all visitors. Site visitors will not be permitted to enter work areas (Exclusion Zone [EZ] and Contamination Reduction Zone [CRZ]) and will be accompanied by the DOE/HQ Project Director, or designated agent, at all times.

During site preparation activities, an area within the support zone will be identified and demarcated for use by site visitors and on-site personnel who do not meet the health and safety requirements for entry into the EZ. This area will provide a secure location for the unobstructed viewing of the soil disposal mound remedial operation.

Upon arrival at the site, all visitors will be required to participate in an orientation program on project health and safety requirements and to sign the Tailgate Safety Meeting Form, in accordance with the SSHASP. In the event that unauthorized individuals visit the site and, upon request, refuse to depart the site, the local Public Safety Officer in Point Hope will be contacted to provide support. Through the distribution of project information to the local public and the on-site presence of their selected representatives, this occurrence and resolution is not expected and is referenced solely as a contingency.

The EZ and CRZ, identified as active work areas, will be demarcated utilizing either rope or caution tape affixed to stakes. Only approved project personnel who meet the requirements specified in the SSHASP will be authorized access to these work areas.

Due to the frequency of bears at the site, armed guards will be employed to protect against possible bear attacks. The utmost restraint will be utilized by the guards and only in definite situations of potential harm to site personnel will firearms be discharged. The use and control of firearms during the project is described in the SSHASP.

6.2 Communications

A satellite communications system will be maintained on-site for the duration of the project. Use of the communications system will be restricted for project-related business and will require authorization from the DOE/NV Project Manager for use. IT will maintain a log of all communications for the project, which will include the following required information:

- Name of Transmitter and Organization
- Name of Receiver and Organization
- Phone Number
- Date/Time of Transmission
- Duration of Transmission
- Reason/Purpose.

On-site communication during the implementation of the remedial action will be accomplished through the employment of two-way hand-held radios. A base station will be operated and monitored at the project field office. Each remedial action team will be equipped with a radio, along with the DOE/HQ Project Director, DOE/NV Project Manager, and IT supervisors, to communicate project information within the project organization.

6.3 Public and News Media Liaisons

During the performance of the remedial action, the DOE/HQ Project Director, or designee, will serve as the on-site point of contact for the distribution of project information to the public and the news media. The DOE/HQ Director will be in frequent contact with local organizations. A public meeting has been scheduled to maintain communication between the project and the local public. Therefore, site visits by the local public are discouraged due to the logistical constraints and the limitation of on-site support services at the base camp. The local public groups will be represented on-site by three members, for the duration of the project. At least one of those members will be the North Slope Borough's third party consultant.

Due to the aforementioned constraints and limitations, local government representatives, and members of the news media will be required to secure pre-approval of visits from the DOE/NV Project Manager and the DOE/HQ Project Director. All visitors to the site are required to adhere to the policies and procedures established in this Site Assessment and Remedial Action Plan.

The DOE/HQ Project Director will serve as the project liaison with the on-site visitors and will be the point of contact for visitors. All comments and questions are to be directed to the DOE/HQ Project Director, or designee. IT personnel and subcontractors are not authorized to interface with visitors on project-related issues. IT has been engaged by the DOE to perform site activities, and in this capacity IT's sole focus is on the performance of site activities in accordance with the DOE-approved Site Assessment and Remedial Action Plan. The IT Project Manager will provide support, as requested, to the DOE in the preparation of project information for communication with site visitors.

6.4 Permit Requirements

The performance of the remedial action is dependent upon the securing of federal, state, and local permits. These permits are required to be approved prior to the mobilization of project organizations to the site. Delays in the securing of these required permits will directly impact the proposed project schedule. The DOE is actively working with the ADEC, USFWS and other applicable organizations to identify and secure the required permits. The following presents the necessary permits, the responsible organizations for securing the permits, and a summary description of the permits.

6.4.1 Site Access Agreement

The DOE is presently negotiating a site-access agreement with the Native Allotment holder for the property adjacent to the tracer study soil disposal mound, which encompasses the area of the original Project Chariot environmental study base camp. Specific easements exist at the site and are, therefore, not to be included in the access agreement. The access agreement will enable the DOE to utilize the existing base camp area as support area for the performance of the assessment and remedial action, thus reducing the potential for disturbance of the tundra environment at the site.

6.4.2 U.S. Fish and Wildlife Service: Special Use Permit

The mound lies within the boundaries of the Cape Thompson Summit of the Chukchi Sea Unit of the Alaska Maritime National Wildlife Refuge created by Section 303 (1)(i) of the Alaska National Interest Lands Conservation Act (ANILCA) (94 stat. 2389). The site is under the jurisdiction of the USFWS. The DOE/HQ is currently interacting with the USFWS to secure a Special Use Permit for performance of site activities.

6.4.3 National Environmental Policy Act (NEPA)

Under DOE Order 5440.1D, all DOE elements and programs nationwide are required to comply with the "letter and spirit" of the NEPA, when proposed site activities may significantly affect the quality of the human environment. In these circumstances, such as the implementation of environmental restoration programs, preparation of NEPA documentation is required. The DOE has provided the funding to support the execution of the NEPA documentation by the USFWS, who have prepared an Environmental Assessment (EA) for this project.

6.4.4 Site Operations Permits

IT Corporation, in conjunction with its selected subcontractor for camp services and the DOE, will work with the ADEC in the securing of applicable permits to operate the support facilities at the project site. Based on discussions with potential local camp service subcontractors, the following permits have been identified:

- Permit for the discharge of treated gray-water (water generated by the base camp services) from site activities, which does not include the disposal of water generated from potential decontamination activities
- Air permit for the discharge of sanitary waste treated via incineration
- Solid waste incineration permit

- Food services permit
- Potable water treatment permit.

6.4.5 Coastal Zone Management Act

The DOE and the ADEC have initiated discussions with the Alaska Coastal Program Coordinator, Division of Governmental Coordination, Office of Management and Budget to determine the requirements that the remedial action will need to address for compliance with the Coastal Zone Management Act (CZMA) (P.L. 92-583). The purpose of the CZMA is to encourage states to preserve, protect, develop, and, where possible, restore or enhance such valuable natural resources as wetlands, flood plains, estuaries, beaches, dunes, barrier islands, and coral reefs, as well as the fish and wildlife using those habitats.

6.4.6 U.S. Army Corps of Engineers Wetlands Permit

The DOE has worked with the Army Corps of Engineers on securing the use of the nation-wide Wetland Permit for the remedial action. The DOE has provided the required information to the Army Corps of Engineers for the Wetlands Permit. Wetlands are defined by Executive Order 11990 on Protection of Wetlands, Section 7 (c), and the U.S. Army Corps of Engineers has the responsibility for administrating activities in Wetlands under the Clean Water Act of 1972 (CWA), as amended (33USC466). Section 404 of the CWA establishes a national program to control the discharge of dredge of fill materials into waters of the United States. "Waters of the United States" include all tributaries of navigable waters up to their headwaters and landward to their ordinary high water mark and all tidal waters up to the high tide line, thus, including wetlands. The section establishes a permit program that is administered by the U.S. Army Corps of Engineers.

This page intentionally left blank

7.0 Mobilization

The mobilization for the remedial action will be performed in a staged format. The mobilization stages are sequenced to optimize the schedule and to provide a smooth transition from mobilization activities to remedial operations.

The equipment and materials to be used for the performance of the remedial action will be procured through vendors that are situated at various locations within both Alaska and the lower 48 states. A common staging area is necessary to coordinate the delivery of these items and to limit logistical issues. Seattle and Anchorage will be used as common staging areas and points of departure for the mobilization activity. Seattle and Anchorage have been chosen to serve this function based on the following factors:

- The Project Chariot site is not equipped with adequate facilities (aircraft landing runways) to directly support the large volume and tonnage of the equipment and materials required to perform the remedial action.
- Vendor services for both equipment and material, which are anticipated to be used for the performance of this project, are available in Seattle and Anchorage.

Stage I

The first elements to be mobilized from Seattle under Stage I will be the empty B-25 LSA containers, Uni-Mats or equivalent, geotextile fabric, high density polyethylene (HDPE) liners and other materials. These items will be transported by low-draft barge from Seattle to Anchorage, where the heavy equipment and other materials will be loaded onto the barge. Upon completion of the Stage I mobilization activity, Kotzebue will serve as the common staging area and point of departure for any additional materials, equipment, and personnel necessary to support the remedial action.

As a contingency, during the course of the remedial action and during acceptable weather conditions, planes that are able to land on the Project Chariot Site's 305-m (1,000-ft) runway may be used to transport support items and personnel from Point Hope to the site.

STAGE II

Stage II of mobilization entails the establishment of the base camp at the site. The base camp will be flown into the site utilizing C-46 aircraft and the existing 670-m (2,200-ft) runway on the east side of Ogotoruk Creek. This runway will be repaired by filling in potholes and trenches with material adjacent to the runway. The camp materials will then be shuttled to the camp site via existing accessways with the bobcat loader and ATVs. Upon the arrival of the materials, equipment, and personnel at the site, the base camp will be set-up and made operational. The base camp will be constructed in the location of the previous base camp used during Project Chariot and subsequent NARL activities. The base camp construction will include:

- Erection of project facilities (tents for living units, mess hall, laboratory, offices, and sanitary use)
- Erection of storage tents
- Assembly of fuel storage containment systems
- Assembly and testing of generators and electrical hook-ups
- Assembly of gray-water treatment system
- Assembly of potable water treatment system
- Assembly of miscellaneous project support areas and equipment (communication systems, weather station)
- Operation of the base camp.

STAGE III

The remediation operational equipment, materials, and supplies will be mobilized to the site via the barge which will proceed from Anchorage directly to the Project Chariot Site. The barge will berth on the shore, on the western side of Ogotoruk Creek, and a ramp will be employed to provide access for loading and unloading operations. Project Chariot personnel will be flown from Kotzebue by either helicopter or plane to the site. In conjunction with the transport of equipment and personnel to the site during Stage II, materials considered vital to the commencement of the remedial action will be delivered. A schedule of materials delivered to the site over the duration of the project will be established and coordinated through Kotzebue, Alaska.

STAGE IV

During Stage IV, the support facilities (decontamination, visitor observation area, and break areas) will be constructed, the on-site laboratory instrumentation will be set-up and calibrated, and the work zone perimeters demarcated. Site personnel will arrive at the site during this stage via charter flight from Kotzebue.

This page intentionally left blank

8.0 Site Preparation

In an effort to minimize potentially adverse impacts to the tundra environment, the remedial operation proposes, to the extent possible, to use existing disturbed areas at the site to serve as support areas. The existing base camp area will be used as the location of the remedial action base camp, storage area, and support zone. Where feasible, existing access ways will be used to traverse the tundra between the base camp and the disposal mound. If existing access ways are unstable, an alternative access way will be established along the ridge, upgradient of the mound as shown on Figure 8-1. This alternative access way will be managed to minimize impact on the tundra.

8.1 Access Way to Disposal Mound

The existing access way will be protected with a layer of geotextile fabric, followed by a layer of Uni-Mats, or equivalent, to spread the load of the excavator when it travels to the disposal mound. This method will reduce the pressure on the tundra to under the 21 kilopascals (kPa) (3 pounds per square inch [psi]) requirement established by the USFWS. The calculations, layout, and specifications for the Uni-Mats are provided in Appendix E. The Uni-Mats, or equivalent, are 14 ft wide by 8 ft long. The excavator will place the Uni-Mats, or equivalent, in front of itself and then move onto the mats. The excavator will then pick up the mats from behind and place them in front of itself. This leap-frog approach will minimize material requirements and will adequately protect the tundra. Sufficient mats will be available for the excavator and front-end loader to travel to the disposal mound together.

It is anticipated that a temporary pipe crossing will be required at Snowbank Creek. Two 12-in. interior diameter corrugated plastic pipes will be installed at the crossing. The pipes will be 6.1 m (20 ft) in length and will be positioned on the creek bottom. Sandbags will be used to back fill this crossing and to channel the water into the pipes. The sand bags will be placed to grade, covered with fabrics and Uni-Mats, or equivalent, to provide a crossing (Figure 8-2). The gravel for the sand bags will be obtained from the stockpiled gravel at the campsite and replaced after site activities are completed. All equipment movement will be restricted to this established route for travel between the soil disposal mound and the base camp. Caution will be taken at all times to minimize unnecessary disturbance of the tundra.

CHARA38 07/02/93 9:30AM JRB

DRAWN BY	R. BATES	CHECKED BY			DRAWING NUMBER	301971.201.07
	05/27/93	APPROVED BY				

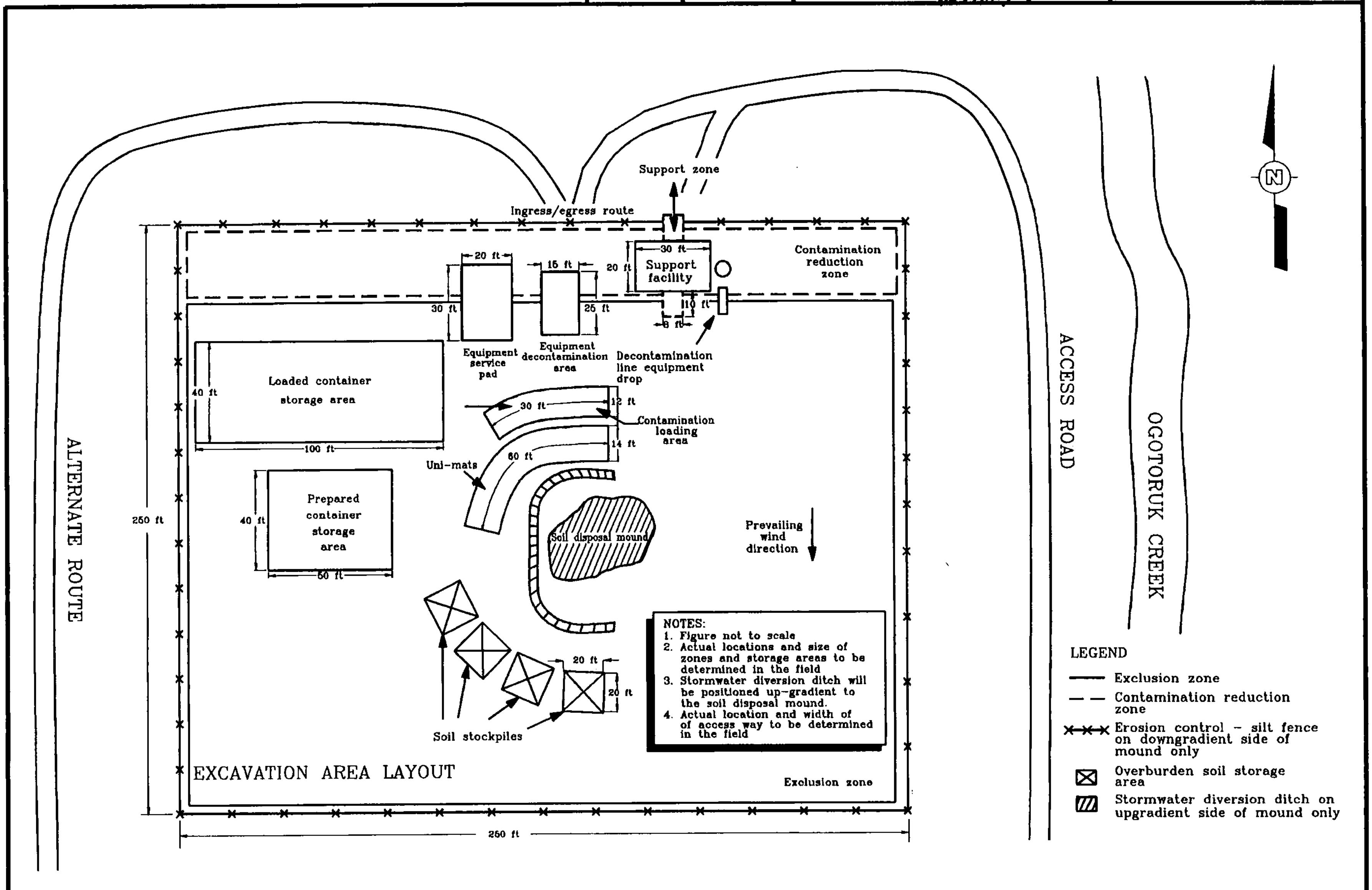
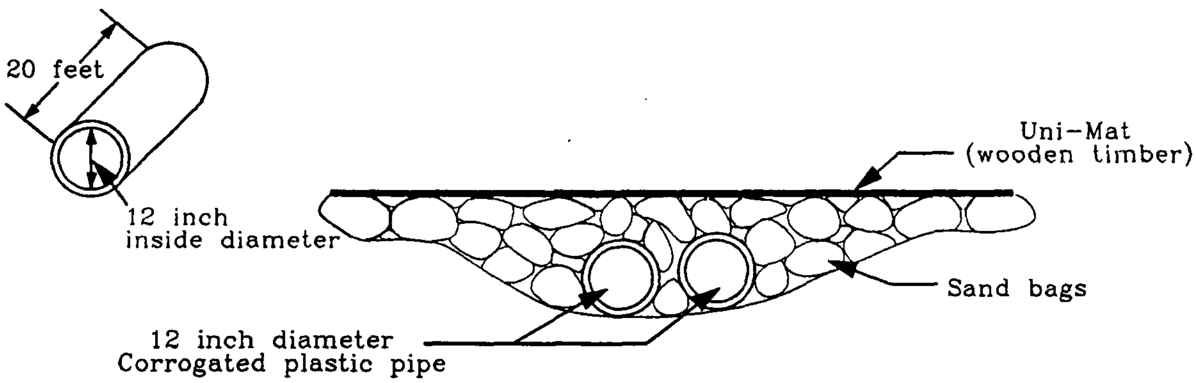


FIGURE 8-1
PROJECT WORK ZONES

DRAWING NUMBER 301971.201.07
DRAWN BY R. BATES 05/27/93
CHECKED BY
APPROVED BY

SNOWBANK CREEK TEMPORARY CROSSING STRUCTURE



1. Where feasible, existing access ways, that were utilized and disturbed during the Project Chariot Site activities, will be employed with the approval of the U.S Fish and Wildlife Service (USFWS) as the route for transportation between the base camp and the soil disposal mound. If existing access ways are unstable, an alternate route to the mound may be necessary.

2. All vehicles utilized to traverse the tundra at the site will attain the USFWS specified 3 psi ground pressure. The transport of the heavy construction equipment, which will occur once (roundtrip) during the project, will achieve the 3 psi ground pressure through the utilization of a Uni-Mat system to distribute the pressure.

3. At Snowbank Creek, two 12 inch (interior diameter) corrogated plastic pipes (CPP) will be positioned in the creek bottom to allow the uninterrupted flow of the water.

4. Sand bags will be installed to stabilize the CPPs in position and to fill the voids between the CPPs and the creek banks.

5. Sand bags will be placed over the CPPs to furnish a stabilized base.

6. A wooden timber crane mat will be placed over the layer of sand bags and span the creek, which is approximately 2 to 3 feet in width at the crossing point.

7. At the conclusion of the remedial action, the creek crossing structure will be removed and transported off site.

FIGURE 8-2
SNOWBANK CREEK
TEMPORARY CROSSING
STRUCTURE

CHARA02 07/02/93 9:00AM JRB

At the conclusion of the project, the temporary pipe crossing will be removed and these materials will be transported off site. The sand from the sand bags will be returned to the beach.

8.2 Transfer of Containers To the Disposal Mound

The empty storage containers (B-25 LSA waste containers) will be transported from the base camp to the disposal mound using a Foremost Nodwell® 110 Muskeg Carrier. The empty containers will be loaded at the base camp with a Cat® 966 loader and off loaded at the mound with another Cat® 966 loader. The muskeg carrier can carry four empty containers at a time and one full container at a time. The route of travel will be the access way described in Section 8.1. However, Uni-Mats, or equivalent, will not be required for the muskeg carrier as the ground pressure of this machine when loaded with 7.2 metric tons (8 tons) of cargo is under 21 kPa (3 psi).

8.3 Container Storage Area Preparation

During the mobilization phase of the remedial action, an area will be identified near the base camp to serve as the temporary storage area for the containerized soil. The selection criteria to be used to identify the area will include a location that:

- Lies outside the mean high tide and flood zone
- Is accessible to transport vehicles from the disposal mound
- Is accessible to the shore line and is near the existing access way
- Can be segregated from the base camp and does not interfere with support operations.

The ground surface at the selected temporary storage area will be graded to a level condition utilizing on-site equipment and existing debris will be removed as necessary. The storage containers (B-25 LSA containers) are constructed with three 4-in. risers positioned on the bottom of the container. The B-25 LSA containers will be placed on support material (dunnage) to protect against the container sinking into the soil. Dunnage material will include railroad ties covered with visqueen.

8.4 Delineation of Project Work Zones

The Project Chariot Site will be segregated into three distinct zones, in accordance with the SSHASP (Appendix B). The three zones are illustrated on Figure 8-1 with the following classifications:

- Support Zone
- Contamination Reduction Zone
- Exclusion Zone.

The Support Zone encompasses the area where no intrusive activities will be conducted. Both the Contamination Reduction Zone (CRZ) and Exclusion Zone (EZ) will be demarcated using either rope and/or caution tape affixed to stakes that will be driven into the ground. Activities to be performed in each of the zones will be conducted in accordance with the requirements detailed in the SSHASP. The actual dimensions and boundary lines of the CRZ and EZ will be determined during the mobilization phase of the project in consultation with the HSO. Buffer areas will be incorporated into these two zones.

8.5 Work Area Preparation

Upon the establishment and delineation of the work zones, the first activity to be conducted in the preparation of the work area will be the survey of the soil disposal mound to establish the excavation lines and limits.

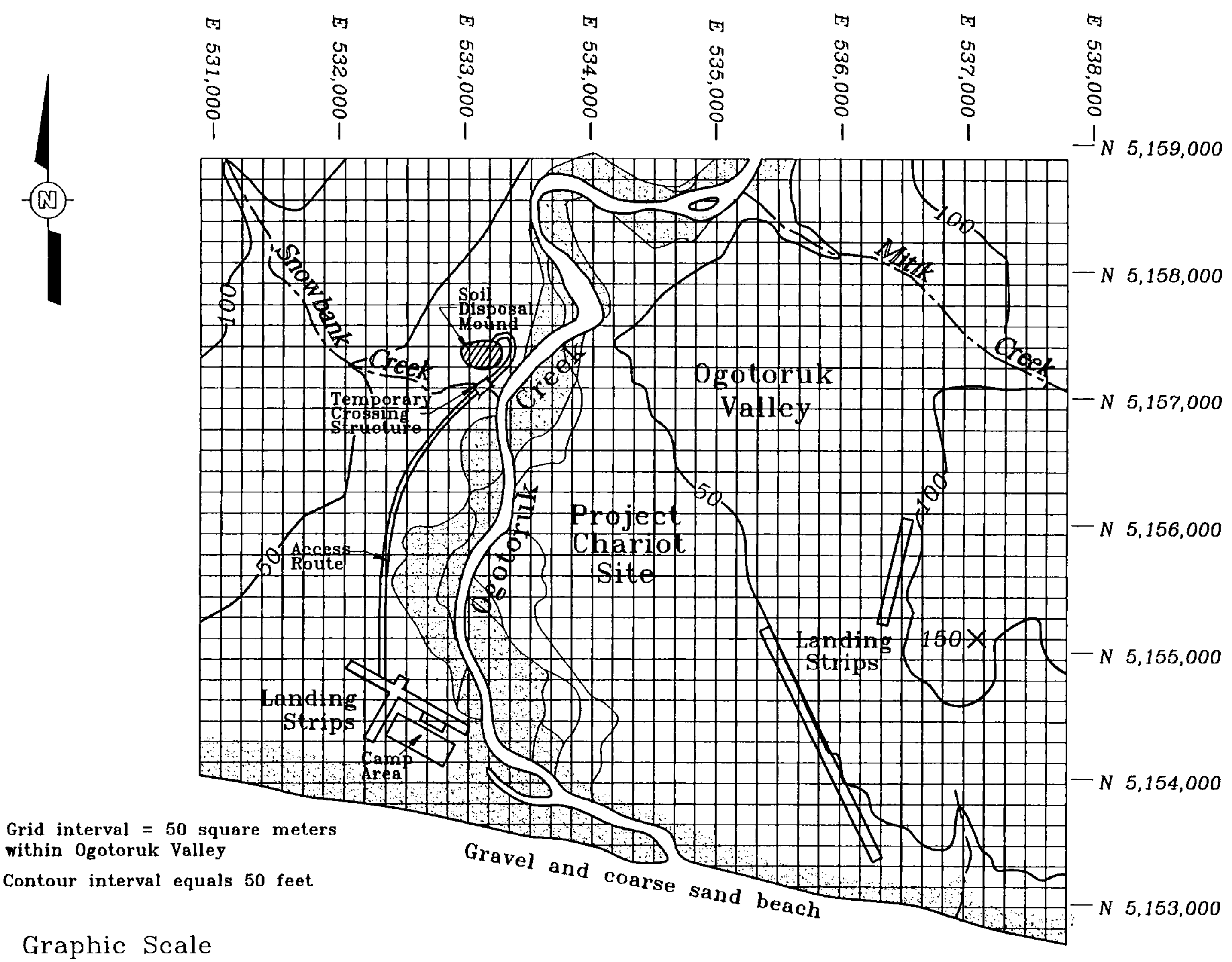
A support facility (heated tent with furniture) will be erected in a designated area within the CRZ. This facility will be positioned up-wind (prevailing wind pattern) from the disposal mound and will serve as a break area for the remediation crew and as a work area for management staff.

Soil erosion and sediment control measures (Section 9.0) will be installed at the project work zone. This Section identifies the control measures, installation locations, sequence of construction, and maintenance procedures.

Upon the completion of the demarcation of the work zones, four pressurized ion chambers (PICs) will be positioned approximately 30 m (100 ft) from the corner points of the EZ. The actual locations of the PICs will be determined in the field during the work area preparation phase. The objectives of the PICs are to record ambient background radiation levels at the site and to monitor the ambient air during the excavation operation.

The tentative project site lay-out for the remedial action is illustrated in Figure 8-3. The actual locations of the base camp and associated support facilities will be established during the initial stages of project mobilization and will be dependent upon current site conditions.

DRAWN BY	R. BATES	CHECKED BY			DRAWING NUMBER	301971.201.07
	05/27/93	APPROVED BY				



Grid interval = 50 square meters within Ogotoruk Valley

Contour interval equals 50 feet

Graphic Scale

0 400 800 Meters

0 250 500 Feet

FIGURE 8-3
PROJECT CHARIOT SITE LAYOUT

9.0 Sediment/Soil and Revegetation

Soil erosion and sediment control practices will be implemented during this remedial action prior to any major soil disturbance. Site revegetation activities will occur at the soil disposal mound, test plots, and along the access road between the base camp and the soil disposal mound after the ADEC and USFWS approve the clean closure of the site.

9.1 Soil Erosion and Sediment Control

The existing access routes established during the Project Chariot Site 1962 test will be used, where feasible, as the transportation route between the base camp and the soil disposal mound. All vehicles will be limited to 21 kPa (3 psi) for traversing on the tundra in compliance with the USFWS requirements. Heavy equipment will use a Uni-Mat system to comply with the 21 kPa (3 psi) requirement.

9.2 Snowbank Creek

At Snowbank Creek, two 12-in. diameter corrugated plastic pipes will be positioned in the creek bottom and secured with sand bags to allow the uninterrupted flow of water. Sand bags will be placed across the pipes to a level equal with the creek bank to provide a relatively flat surface. A wooden Uni-Mat will be placed over the sand bags to span the creek, maintain the integrity of the sand bags, and provide a stable surface for vehicles and personnel to traverse. At the conclusion of the activities, this structure will be dismantled and the sand will be returned to the beach.

9.3 Soil Disposal Mound

A silt fence will be constructed around the perimeter of the work zone to minimize ingress, egress, and provide protection from rain water runoff. Fence posts will be placed 2.4 m (8 ft) up slope and parallel to the posts. A 15 by 15-cm (6 by 6-in.) trench will be excavated directly in front of the posts. Wire fencing will be attached to the fence posts and covered with filter fabric that extends into the excavated trench. The soil will be backfilled and compacted in the trench to secure the filter fabric.

A 30 by 15-cm (1 ft by 6-in.) deep ditch will be excavated around the soil disposal mound to divert storm water away from the mound. The ditch will be excavated around the upgradient sides of the mound.

The soil overburden removed from the mound will be stock-piled on high-density polyethylene (HDPE) sheeting and covered with HDPE. After surveying the soil for radioactivity and collecting the appropriate waste samples, excavated soil above established cleanup levels will be placed in the low specific activity containers. The stockpiled overburden soil that is determined to be below established clean-up levels, will be backfilled into the excavated area. The ADEC will approve the clean closure of the soil disposal mound before site revegetation will occur.

9.4 Site Revegetation

The area will be graded to match existing contours, to a relatively smooth, non-compacted condition for replanting as determined by the Division of Natural Resources (DNR). Upon completion of the revegetation preparation activities, the following plant seed mixture will be applied to the disturbed area:

43	percent	Bering Hairgrass
32	percent	Arctared Fescue
12	percent	Alyeska Polar Grass
7	percent	Egan Slough Grass
6	percent	Tundra Blue Grass

The application rate of the seed mixture will be approximately 14 kg (30 lb) per acre. Free flowing, granular 20-20-10 fertilizer will then be applied at a rate of 270 kg (600 lb) per acre. All seeding and fertilizing will be done by a broadcast method, using heavy duty cyclone type chest seeder equipment. One layer of Excelsior blankets will be secured over the seeded and fertilized area.

10.0 Soil Excavation

Historical photographs taken in 1962 during the tracer study illustrate the phased formation of the soil disposal mound and serve as a basis to document assumptions of the volume of soil generated by the tracer study. These assumptions have been confirmed during interviews conducted by DOE with individuals who performed the study and who were present during the soil disposal mound formation. The tracer-study-generated soil was emptied from the 55-gallon drums directly onto the native soil, and the wooden boards and polyethylene sheeting were placed in with this soil. Based on the review and evaluation of this information, the volume occupied by this soil is estimated to be approximately 12 m (40 ft) in width, 12 m (40 ft) in length, and 0.46 m (1.5 ft) in depth. Approximately 1.2 m (4 ft) of cover soil was placed directly onto the tracer-study-generated soil. This cover soil (overburden) did not contain any of the tracer study material.

The soil disposal mound will be excavated in a sequential manner. The upper 1.2 m (4 ft) of overburden will be excavated in pre-established 0.3-m (1-ft) lifts. Excavation of each lift will proceed over the entire mound, and each lift will be stockpiled in segregated areas on HDPE liners. Each stockpile of overburden soil will be covered with a HDPE liner, and the liner will be secured utilizing sand bags and/or stakes. Prior to excavation of each subsequent lift, the surface of the mound will be screened using radiologic surveying instruments. Composite soil samples will be collected and analyzed on site from each of the stockpiles, in accordance with the procedures described in the SAP. Based on the results of this analysis, stockpiled soil that exceeds the established clean-up level will be subsequently containerized for disposal. Overburden soil that is determined to be below the established clean-up level will be used as fill to restore the mound area. At the excavation line where the tracer-study-generated soil exists, 0 to 0.6 m (0 to 2 ft) above grade, the soil will be excavated and loaded directly into the B-25 LSA containers for disposal.

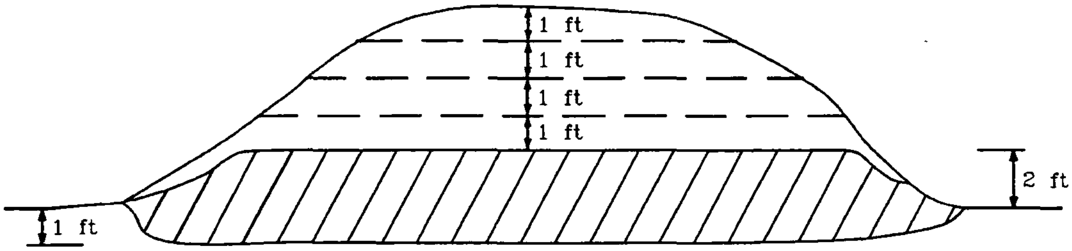
10.1 Excavation Technique and Procedure

Prior to commencing the excavation, the soil disposal mound will be surveyed and the lines of excavation (lifts) demarcated (Figure 10-1). A Caterpillar 330L excavator, or equivalent, will excavate each lift over the entire mound, using a digging bucket or a frost bucket. Each of the upper four lifts will be stockpiled in segregated areas on HDPE liners in a location directly adjacent to the mound. The segregated stockpiles will be covered with HDPE liners

DRAWING NUMBER 301971.201.07

DRAWN BY R. BATES 05/27/93 | CHECKED BY | APPROVED BY

CHARA03 07/02/93 9:00AM JRB



Sequence of Soil Disposal Mound Excavation

1. The soil disposal mound will be surveyed to establish approximately one foot vertical increments (lifts) over the entire mound.
2. The soil erosion and sediment control measures will be installed, in accordance with the soil erosion and sediment control plan.
3. The surface of the mound will be surveyed utilizing radiological survey instruments and waste samples will be collected in accordance with the Sampling and Analysis Plan.
4. Excavation of the mound will be performed utilizing a track excavator (Caterpillar 330L or equivalent) equipped with a frost bucket.
5. Excavation of each lift will proceed over the entire mound and each lift will be stockpiled on polyethylene sheeting. Each stockpile of soil will be covered with polyethylene sheeting that will be secured utilizing sand bags and stakes.
6. During non-operation hours, the exposed mound will be covered with sheeting that will be secured with sand bags and stakes.
7. Prior to the excavation of each subsequent lift, the surface of the newly exposed mound will be surveyed with radiological survey instruments.
8. Composite soil samples will be collected from each of the stockpiles and analyzed on site in accordance with the Remedial Action Plan/Sampling and Analysis Plan. Based on the laboratory analysis results, stockpiled soil that exceeds the established clean-up level will be subsequently placed into the B-25 Low Specific Activity (LSA) containers for disposal. Overburden soils that are determined to be below the established clean-up level will be utilized to fill the mound area to grade after the completion of the remedial activities.
9. At the excavation limit where the tracer-study-generated soil exists (i.e., minus one foot to plus two feet elevation at grade), the soil will be excavated and loaded directly into the B-25 LSA containers for disposal.
10. Post-excavation soil samples will be collected from the base and sidewalls of the excavation and analyzed in the on-site laboratory. Upon approval by the Alaska Department of Environmental Conservation for final closure, the activity will be completed.
11. The clean overburden soil will be graded into the open excavation.
12. The disturbed areas will be revegetated in accordance with Chapter 9.0, Soil Erosion, Sediment Control, and Revegetation of the Remedial Action Plan.
13. The soil erosion and sediment control measures will then be removed.

FIGURE 10-1
SOIL DISPOSAL
EXCAVATION PROCEDURE

and the liners will be secured using sand bags and stakes. During non-working hours the exposed mound area will be covered with HDPE liners, which will be secured using stakes and sand bags.

Once the excavation of the upper four lifts has been achieved, the remaining mound will be surveyed. The soil positioned at the 0 to 0.6-m (0 to 2-ft) elevation line, above grade, will be excavated and loaded directly into the B-25 LSA containers for disposal. All excavation will be performed by the Caterpillar® 330L excavator working from the perimeter of the mound on Uni-Mats. The boom of this excavator has sufficient reach to perform the excavation, which eliminates the need to traverse onto the mound. Manual excavation will be performed, as dictated by site conditions, to support the excavator. A Caterpillar® 966, or equivalent, loader will stage the empty containers adjacent to the excavation onto HDPE liners and shuttle the loaded containers to a staging area within the EZ. Two laborers will assist with any hand shoveling required and to containerize any spillage that may occur during the loading operation. They will also spot the empty containers and brush any loose material off the loaded containers. All loose material removed from the containers and HDPE liners will be containerized for disposal.

Grade will be checked as the excavation proceeds, and the radioactivity levels will be monitored. Upon completion of the excavation, post-excavation soil sampling and testing will be performed as described in Section 11.0. At this point in the operation, the exposed excavation area will be protected using insulation blankets and HDPE liners to prevent disturbance to the underlying permafrost. The protection system to be installed will be in accordance with the specifications required by the USFWS. The results of the post-excavation sampling will determine if additional excavation is required. Upon receipt of ADEC approval of closure, the excavated area will be backfilled with the clean stockpiled soil and graded to meet the natural contour of the terrain. This disturbed area will be restored to natural conditions and seeded with recommended plant materials in accordance with the USFWS and DNR-approved Site Restoration Plan.

During all on-site operations, personnel decontamination will be performed in accordance with the requirements and procedures detailed in the SSHASP (Appendix B).

Fugitive dust is not anticipated to be a big issue during the excavation of the soil disposal mound due to the following factors:

- Site soils contain approximately 20 percent moisture content during the summer months. Through cohesion, the moisture limits the formation of dust that could be dispersed by the wind.

- Excavation techniques will be employed that limit the potential for wind dispersion by loading the excavated soil directly into the containers from the point of excavation.

- Four PICs will be positioned approximately 30 m (100 ft) from the corner points of the EZ to monitor the excavation operation.

- A soil analysis conducted by the Agricultural Experimental Station at Ohio State University (1961) shows that most of Ogotoruk Valley is overlain by at least 0.3 m (1 ft) of peat. One third of the way down from the crests of the hills and extended to the shelf (terrace) area of the creek, the soil is a mixture of peat and clay, with varying amounts of small rocks. The creek terraces (located about 1 m [3 ft] above the creek bed) are composed of black soil vegetated with scrub willows and mosses between the willows. The Project Chariot Tracer Study disposal mound lies within these two regimes. Permafrost generally exists immediately beneath the vegetation cover. The thawing of permafrost during the summer months will release excess moisture to the soils. This release of moisture coupled with the aforementioned soil types that presently exist at the site should preclude any incidence of fugitive dust.

The same dry soil was encountered on the top of the mound. Fugitive dust from this small area will be controlled by wetting the soil with water from Snowbank Creek.

During the excavation of the soil disposal mound, three high-volume particulate samplers will be operated at monitoring-stations within the EZ. These stations will be located down-wind of the excavation at an approximate distance of 30 m (100 ft) from the mound. The actual locations of the stations will be determined during site preparation activities. The objective of the high-volume particulate sampler is to monitor any potential fugitive dust generated by the excavation of the soil disposal mound and associated remedial activities (staging of overburden soils and the loading of soil containers). The samplers will be operated during the hours when the excavation is being performed. The filters will be removed from the samplers and surveyed on site twice daily. The filters will be analyzed on site utilizing a Ludlum® Model 2929, dual channel alpha, beta/gamma scintillation counter. This analysis will identify the presence of alpha, or beta/gamma emissions associated with fugitive dusts.

The SSHASP (Appendix B) describes the health and safety issues related to fugitive dust in relationship to remedial operations.

10.2 On-Site Laboratory Instrumentation

As the excavation operation progresses, soil samples will be collected and analyzed utilizing on-site laboratory instruments. The sampling and on-site analytical procedures are described in the Sampling and Analysis Plan (SAP), Appendix A. The objective of the in-field analysis of soil samples is to identify any potential elevated levels of radioactivity above the clean-up levels prior to implementing post-excavation sampling and analysis. The implementation of the field analysis task should enable the execution of a one-time confirmatory post-excavation sampling effort.

10.3 Container Preparation, Loading, and Temporary Storage

All removed soil will be placed into Model B-25 LSA, "Strong Tight Containers" (refer to Figure 10-2). Upon delivery of the containers to the site, each container will be inspected for physical integrity by the Waste Certification Officer. Any containers that appear to be damaged (holes or severe dents) will not be used for the project. The empty containers will be staged in the EZ. The tops will be removed, and adsorbent material will be placed into the bottom of the containers. The adsorbent material will be used to absorb the moisture generated by the thawing of the soil. A Caterpillar® 966 Loader will transfer the prepared containers to the excavation area and stage the containers onto HDPE liners. The excavator will load the containers with excavated material. Any loose material will be physically removed from the outside of the loaded containers. The loader will then transfer the loaded containers to a second staging area within the EZ.

At the second staging area, the loaded containers will be numbered and sampled, as specified in the SAP. Additional absorbent material will be placed on the soil, and the B-25 LSA top will be secured. The surface of the loaded and closed containers will be decontaminated and radiologically surveyed, in accordance with the decontamination procedures identified in the SSHASP. The containers will then be transferred to the temporary storage area at the designated area within the base camp. The transfer is anticipated to be performed with a Muskeg® carrier between the mound and base camp. Each container will be loaded on a Muskeg® carrier, and transferred to the temporary storage area near the base camp.

DESCRIPTION

Classification	LSA waste container
Package type	CFR specification "Strong-Tight"
Capacity	90 cubic feet
Material	ASTM A-569 low carbon hot rolled steel
Gross Weight (Empty)	445 to 895 Pounds
Payload	4,000 to 10,000 pounds
Max Loaded Weight	4,445 to 10,895 pounds

ADDITIONAL INFORMATION

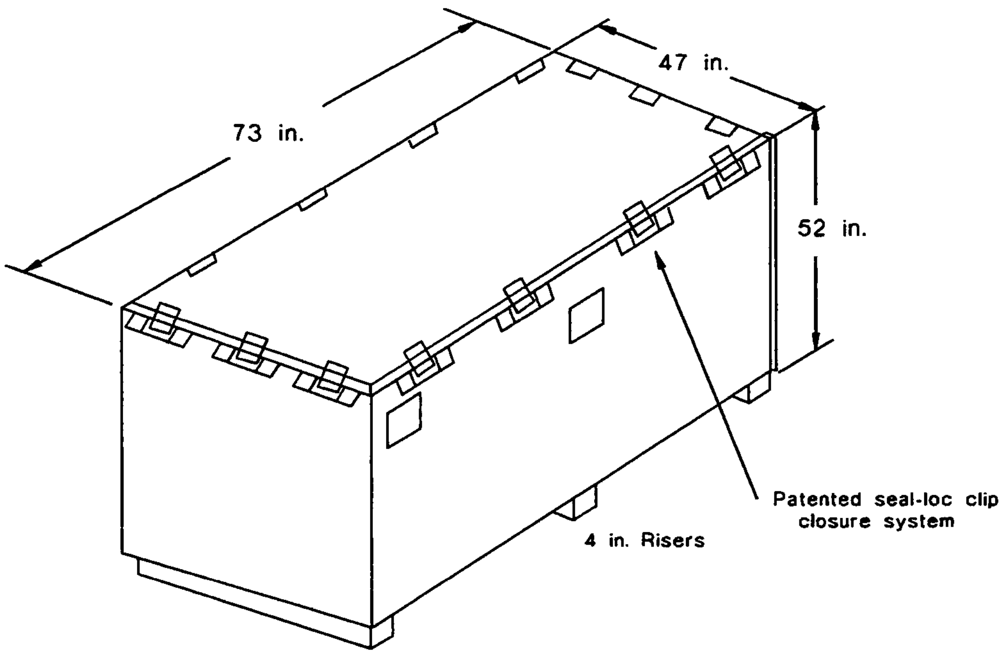
Meets general container requirements (49 CFR 173.24) for asbestos, ORM and hazardous waste materials.

Patented, exclusive "seal-loc" positive closure system to preclude inadvertent opening.

Optional removable risers.

Optional anti-springback retention system for compactor application.

Final protective finish to meet customer requirements optional shielding available.



U.S. Patent Nunbers 4371092 AND 4426927
(REFERENCED FROM CONTAINER PRODUCT CORPORATION)

FIGURE 10-2
B-25 LSA WASTE CONTAINER FOR THE STORAGE AND SHIPPING OF LSA MATERIALS

DRAWING NUMBER 301971.201.05
CHECKED BY
APPROVED BY
R. HYNA 06/07/93
DRAWN BY

CHARA24 06/10/93 11:35M ADW

The temporary storage area is anticipated to be on the gravel base adjacent to the small runway. The containers will be stacked on either railroad ties placed in HDPE or visqueen or dunnage to minimize settlement. These containers will remain in storage until receipt of ADEC approval of final closure of the soil disposal mound and test plot areas. The containers will then be loaded onto the barge for transportation to the disposal facility.

10.4 Equipment, Support Services, and Contingencies

The equipment required to perform the excavation is as follows:

Qty	Description and Attachments	Weight (each)
2	Caterpillar® 966 Front End Loader w/Fork Attachment	20,410 kg (45,000 lb)
1	Caterpillar® 330L Excavator w/Frost Bucket	33,570 kg (74,000 lb)
1	Nodwell® 110 Muskeg Carrier (2-man cab)	10,340 kg (22,800 lb)
1	Nodwell® 60 Muskeg Carrier (6-man cab)	5,000 kg (11,000 lb)
1	743B Bobcat® Loader w/bucket and fork attachments	2,160 kg (4,750 lb)
8	Honda® Four-Wheelers (ATV)	
1	Camp Facility with Generators, Incinerator, Pumps, Fuel Reservoir System, Heaters, etc.	34,000 kg (75,000 lb)
1	Mechanics Truck (Ford® F-350) with tools	5,500 kg (12,000 lb)

The support services required to repair and maintain this equipment are as follows:

- Camp Mechanic - full service with tools and parts for camp facility maintenance
- Heavy Equipment Mechanic - full service mechanic truck with tools and parts for fueling, service, and repair of equipment. The truck will remain in the camp area at all times and will not be allowed to traverse any tundra.

One Muskeg® Carrier will be used to transport fuel and supplies daily from the camp area to the disposal mound. The fuel will be pumped into 55-gallon drums in 85-gallon overpacks for secondary containment on the rear deck of the Muskeg® Carrier. The fuel will be transferred from the drums directly into the equipment at the service pad with a hand transfer pump. A service pad will be established in the CRZ. This service pad will have a HDPE liner with a railroad tie berm to contain any spills that occur while fueling or servicing the equipment. The required Spill Prevention Control and Counter measures (SPCC) plan will be available on-site (Appendix D).

10.5 Tracer Study Test Plot Removal

In the event that the radiological survey results indicate elevated radioactivity levels above the established background level at the tracer-study test plot areas, those identified areas within the test plots will be manually excavated. Hand shovels will be utilized to excavate the areas. Excavation will proceed at approximately 8-cm (3-in.) lifts over the area, and the area will be surveyed, in accordance with the procedures described in the SAP (Appendix A). This procedure will continue until the established background level or cleanup level is attained. The excavated soil will be placed directly into 5-gallon plastic pails with securing lids. The pails will be transported directly to the EZ and emptied into a B-25 LSA container for disposal.

The removal operation for each identified test plot area will be documented and photographed in accordance with the QAPjP. Specific information, which will be recorded, includes:

- Date/Time
- Test Plot Number/Area
- Location
- Initial Survey Results
- Quantity of Soil Removed
- Post-Excavation Survey Results.
- Employees name.

This information will be submitted to the on-site ADEC representative for review and approval. The receipt of ADEC's expedited in-field approval of final closure will be documented and will constitute the achievement of the remedial action objective.

11.0 Soil Disposal Mound Clean-up Verification and Closure Approval

11.1 Post-Excavation Sampling and Analysis

Subsequent to the completion of all excavation/removal activities, post-excavation or "clean" closure sampling will be implemented to verify that the excavation of the soil disposal mound has been accomplished to the point that an established clean-up level has been reached. The attached SAP proposes using a hexagonal grid sampling design to accomplish this effort. This method for selecting sampling locations is described in *Field Manual for Grid Sampling of PCB Spill Sites to Verify Cleanup* (EPA, 1988), which is referenced as a best-engineering practice. Hexagonal grid sampling has the characteristic of typically being easy to implement under field conditions. The grid design is essential to obtain a representative sample of the site and greatly increases the chances of detecting areas that exceed the established clean-up level if they exist.

All post-excavation soil samples collected for analyses will be analyzed for gross alpha and gross beta activity, and gamma spectroscopy. The analytical results will be compared against background samples collected from the site and used for approval of closure.

11.2 Alaska Department of Environmental Conservation Field Approval of Closure

Upon receipt of the post-excavation sampling analysis report from the laboratory, the results will be tabulated with their corresponding sampling locations. These data and associated quality assurance/quality control (QA/QC) data packages will be evaluated to determine if the required clean-up level has been achieved. In the event that the results indicate that the required level has not been achieved, additional excavation will be performed in the area of concern, as described in Section 10.0. This area will then be resampled and the samples analyzed following the procedure described in the SAP to confirm the completeness of the excavation. Once the post-excavation sampling analysis data establish the attainment of the established clean-up level, a summary report will be prepared and submitted for the ADEC's review and approval. The receipt of the ADEC's expedited in-field approval of final closure will be documented and will constitute the achievement of the remedial action objective.

12.0 Soil Transportation

Barge transportation has been selected as the mode of transportation for relocating the containerized soil from the Project Chariot Site to Seattle and then trucks will transport the containers to the NTS. The selection of barge transport was based on the following factors:

- Safety consideration involved with multitrip air operations
- The barge offers a safe and economical method of transportation for equipment and materials to and from the site
- The use of a barge offers an economic advantage over air transport
- The barge will be able to transport all of the anticipated soil containers in one trip, in lieu of the large number of trips required by aircraft.

The load-out and transportation of the soil containers from the Project Chariot Site to the NTS is scheduled to occur upon receipt of ADEC approval of the soil disposal mound and test plot areas final closures and subsequent demobilization of project operations.

A low draft barge, equipped with a loading ramp and tug will be used to transport the soil containers to Seattle. The barge will provide the required capacity to accommodate all of the containers generated during the remedial action.

Prior to loading, the containers will be inspected and surveyed for external radioactivity. The front end-loader with fork attachments will then load the containers onto the barge, where they will be secured in accordance with DOT regulations. As applicable, based on the soil waste profile characterization, DOT transportation documents (manifest and/or bill of lading) will be prepared by IT and executed by the DOE/NV Project Manager (refer to SOP-CHR-05).

Upon completion of the container loading operation, all project equipment and surplus materials and supplies will be loaded onto the barge. The barge will proceed directly to Seattle, Washington. At the Seattle barge terminal, the containers will be transferred onto trucks. The containers will then be trucked to the DOE's disposal facility at the NTS for disposal of the containerized soil. All project equipment and surplus materials will then be returned to Seattle and/or Anchorage.

This page intentionally left blank

13.0 Radioactively Contaminated Soil Disposition

The proposed remedial action for the Project Chariot Tracer Study may result in the excavation of approximately 45 m^3 (60 yd^3) of radioactively contaminated soil. A DOE disposal site has been proposed to receive and dispose of the contaminated soil at the NTS near Las Vegas, Nevada. The following sections describe the procedures necessary to obtain approval to ship the waste and the Waste Acceptance Criteria for the proposed site. Detailed sampling plans, shipping documentation, procedures, and other required documentation will be developed to ensure that all of the applicable waste acceptance criteria and disposal facility standards are met.

13.1 Nevada Test Site

According to the *Nevada Test Site Defense Waste Acceptance Criteria, Certification, and Transfer Requirements,* NVO-325, Revision 1, approval for waste acceptance at the NTS of waste generated at Project Chariot Site is made on a case-by-case basis by the DOE/NV. The approval process includes (1) waste generator approval by DOE/HQ and DOE/NV, (2) approval of an application to ship waste, and (3) successful completion of an on-site audit of the waste management and certification program. If the waste generator receives approval for waste acceptance at the NTS, the waste may be characterized and prepared for shipment to the site for disposition in accordance with NVO-325 requirements.

13.1.1 Waste Generator Approval Process

The Project Chariot contractor will serve as the waste certifier for waste generated by the project. An application to ship waste is on file with the DOE/NV. The elements of the application to ship waste are summarized below:

- Administrative information, such as facility name and location, signature page, DOE/NV name and contacts, name of the waste certification official and alternates, justification for shipment to the NTS, funding method, and waste minimization plan statement.

- Waste characterization program information, which includes a sampling plan, waste analysis requirements, discussion of data reporting methods, rationale for number and location of samples identification of the laboratory performing analyses and results of laboratory audit (conducted by the waste certifier).

- Waste stream information, which includes a waste stream identification number; description of waste type (low-level, mixed, etc.); description of the waste form; waste certification flow diagram; waste acceptance criteria statements demonstrating how each of the 28 waste acceptance criteria is met; three-year shipment forecast; packaging and shipping information, including results of package vendor audit conducted by the waste certifier; and waste security information.

- Waste certification program plan information, which includes the elements of a Quality Assurance Project Plan and describes how the waste management and certification process will be controlled so the waste may be appropriately certified.

- Exemption requests, which explain what waste acceptance criteria waiver is requested and provides a rationale, duration, and corrective action plan for each exemption.

- Procedures and supporting documents, which include procedures for sampling, analysis, packaging, shipping, and certifying the waste.

Many of the elements required in the application to ship waste are already satisfied for Project Chariot Site waste through this document; others will require generation of new documents such as plans and procedures. The elements requiring generation of new documentation are summarized in the sections that follow.

13.1.2 Waste Characterization

Waste characterization data must be sufficient to permit proper identification, minimization, segregation, transportation, and disposition. As a minimum, the following waste characterization information shall be provided for waste to be accepted for disposition at the NTS:

- Physical and chemical characteristics of the waste and any void-filling or absorbent material

- Volume of the waste and any solidification media

- Weight of the final waste package

- Radionuclide distribution, concentration, and activity in the waste matrix

- Method of analysis used to determine radionuclide distribution and concentration

- Adequate data to ensure that the waste is not mixed waste

- A sampling and analysis plan that describes the rationale for the characterization method(s) chosen. This includes demonstration that the samples collected were representative of the waste form or that the process is fully controlled if process knowledge is used for characterization.

- Packaging details, including vendor audit results and a demonstration of how the packaging meets NVO-325 requirements

- Transportation category

- Waste acceptance criteria statements describing how each of the 28 criteria is met and cross-referenced to any procedures that are used to ensure that waste acceptance criteria are met

- Special security information, such as requirements for classified waste

- Flow diagrams demonstrating the waste certification process

- Method of providing standardized laboratory data packages.

Characterization data must be adequate to appropriately classify the waste. For Project Chariot Site waste, it is understood that the fully validated waste characterization laboratory data packages may not be available until after the waste is shipped; however, preliminary data will be available before shipment.

13.1.3 Waste Preparation and Shipment

Concurrent with or after scheduling shipments of radioactive solid waste, but prior to shipping, the following actions must be performed:

- Sample, analyze, package, and certify the waste in accordance with the requirements and methods outlined in the application to ship waste and supporting procedures

- Prepare accurate, complete, consistent shipping, storage (if applicable), and disposal documentation

- Address the shipment to the designated department at the NTS

- Provide lifting, handling, and rigging instructions for all waste packages in excess of 4,000 kg (9,000 lb) (it is expected the Project Chariot Site packages will exceed 4,000 kg [9,000 lb]).

Waste shipments must be scheduled in advance of actual shipment. A staging area will be designated at the NTS prior to arrival of the shipment. This staging area will serve as a holding area for completion of the certification process (if necessary) prior to disposal.

14.0 Environmental Verification

14.1 Radiological Surveys

The environmental verification tasks consist of site assessment tasks designed to verify that the soil removal at the tracer plot sites was complete and that there are no other sites showing higher than natural background readings due to human activity.

The first proposed task for the remedial action environmental verification is the performance of an aerial radiological survey and a ground radiological survey. The detailed procedures of the radiological surveys are described in the SAP (Appendix A). The surveys will focus on characterizing the surface radiation fields, in a systematic fashion across the Ogotoruk Valley and along Snowbank Creek to locate the original experimental plots from Project Chariot Tracer Study to verify that the radioisotopes used have been removed. Prior to collecting radiation measurements, a visual walkover of the area to locate the five test plots will be performed. If any plots can be identified, that area will be marked off with stakes and surveying tape. After this is completed, a grid pattern will be established and marked off from the confluences of Snowbank Creek and Ogotoruk Creek to where the two tributaries of Snowbank Creek meet. The grid will extend laterally from the creek by a distance of at least 30 m (100 ft) on both sides of the creek.

14.2 Surface Water and Sediment

The second proposed task for the remedial action environmental verification is to collect surface water and sediment samples from Tributary No. 3 of Snowbank Creek, Snowbank Creek and Ogotoruk Creek to assess any potential transport of radioisotopes from the 1962 Tracer Study. Twenty-one sampling locations have been tentatively located (seven on Tributary No. 3, seven on Snowbank Creek, five on Ogotoruk Creek, and two from the Ephemeral pond). The sample locations (i.e., sediment) will be areas of fine-grained depositional environments. Areas of fast-water coarse-grained deposits, and obvious scour areas will be avoided. Sediment samples will be collected using a Wildco™ Hand Core Sediment Sampler. Surface water samples (collected at the sediment sample locations) will be collected from mid-channel and will avoid bottom sediments.

This page intentionally left blank

15.0 Demobilization

Upon receipt of ADEC approval of the soil disposal mound and test plot areas closure, final closure and demobilization of project equipment, surplus materials, support services, and staff will commence in a staged format. The stages of demobilization are sequenced to optimize the schedule and provide continuity for the transition from remedial operations to demobilization.

15.1 Equipment Decontamination

Equipment decontamination will be performed using hand tools (shovels, picks, and wire brushes) to remove the gross soil affixed to the wheels, undercarriage, and areas that were in contact with the soil mound. Soil that is removed during decontamination will be containerized in the B-25 LSA containers. Subsequent to the removal of the gross material, all surface areas will be wiped down with cloths, and the resultant material and cloths will be placed in the separate B-25 LSA containers.

An equipment decontamination pad will be constructed in the CRZ utilizing 60-millimeter polyethylene sheeting and wooden railroad ties 15 by 15-cm (6 by 6-in.). An area of an approximate size of 1 m^2 (10 ft^2) will be identified within the CRZ. The polyethylene sheeting will be placed directly onto the ground surface with the wooden boards serving as a berm on all four sides. The sheeting will be draped over the boards to provide containment. A layer of granular adsorbent material will be applied over the sheeting to absorb the liquid generated by the decontamination process. A high-pressure steam washer will be used to decontaminate those portions of the equipment that were in direct contact with the soil disposal mound, specifically the back-hoe bucket and boom. Upon the conclusion of the decontamination process, additional absorbent material will be added, as necessary, to remove all free water within the decontamination pad. The contents of the pad and the sheeting will be manually loaded into the B-25 LSA containers for disposal.

Wipe samples will be taken in accordance with the SSHASP at predetermined locations for each piece of equipment. The wipe samples will be analyzed on-site using the methods specified in the SSHASP. In the event that the analysis results indicate levels above levels identified in the SSHASP (Appendix B), which are the DOE release values specified in DOE Order 5480.11, the decontamination process will be continued until the specified level is achieved. Once the decontamination is approved by the HSO and certified by the DOE/NV Project Manager, the equipment will be released for demobilization. All small hand tools and sampling tools will be surveyed and wiped. If the equipment is found to be contaminated and cannot be decontaminated by physical means, it will be containerized for disposal in separate B-25 LSA containers along with other expendable material used in the EZ.

15.2 Operations Demobilization

Once the determination is made that the remaining equipment and remediation crew have completed the required site activities and the DOE/NV Project Manager has approved the site-closeout inspection, demobilization will commence.

Surplus materials and equipment that are not required for the dismantling of the base camp will be the first items demobilized from the site along with the containerized soil. These items will be transported via barge from the Project Chariot Site to Seattle, Washington. Project personnel will be demobilized from the site via airplane to Kotzebue, where transportation to their final destination will be provided by commercial aircraft.

Upon receipt of certification of decontamination of the EZ equipment and the completion of the barge loading operation, the base camp will be dismantled and demobilized from the site. Based on the final contractual agreement reached with the base camp service subcontractor, it is anticipated that the base camp will be demobilized directly from the site to the subcontractor's operation site.

As equipment and surplus materials arrive at Kotzebue, transportation to their final destination will be provided. The remedial action will be considered complete at the point where all items have been transported from Kotzebue to their final point of destination.

15.3 Site Close-Out Inspection

The DOE/NV Project Manager and the IT Project Manager will conduct a site close-out inspection. The IT Project Manager will develop a "punch list" of work items to be completed in accordance with the remedial action scope of work. IT will be solely responsible for the demobilization of all IT project equipment, materials and staff from the site and the securing of the B-25 LSA containers onto the barge. The DOE/NV Project Manager will inspect the site, with the IT Project Manager, and note any deficiencies, which will be corrected by IT in an expedited manner. When the DOE/NV Project Manager finds work is complete, he will issue certification of final acceptance. Upon receipt of final acceptance, the remaining equipment and staff will be demobilized from the site.

16.0 Project Close-Out Report

IT will prepare and submit to DOE/NV for approval a Project Close-Out Report within 45 calendar days from the date that demobilization from the project site is completed. The Project Close-Out Report will serve as a record document for the remedial action project, will present a summary of the site history and site details, and will document all site activities performed during the remedial action and the project as completed. Pertinent on-site decisions rendered by all participating organizations during the remedial action will be presented and discussed as to their implication to the project. Post-excavation confirmatory sampling and analysis results, which illustrate sample locations and analytical results found in the sides and floor of the limits of excavation, will be presented along with ADEC final approval of closure certification. The final excavation limits and volume of soil removed and containerized will be documented. Project records will be presented as attachments to the report and will include:

- Laboratory analyses and QA/QC data packages
- Chain-of-custody documents
- Health and safety records
- Site photographs
- Engineering calculations
- Decontamination certifications
- ADEC Final Closure Approval certification
- Copy of Project Log.

An assessment of the analytical results of the surface water and sediment sampling of Snowbank Creek will be presented. The assessment will present the laboratory analysis, QA/QC data packages, and discuss the evaluation of the results, along with conclusions and recommendations.

Addenda and/or modifications to the Project Chariot: 1962 Tracer Study Site Assessment and Remedial Action Plan will be appended to the Close-Out Report. All change orders and modifications to the project scope of work will be provided and documented in the reports.

An addendum to the Project Close-Out Report will be prepared and submitted to DOE/NV for approval at the completion of the transportation of the containerized soil to the disposal facility. This is tentatively schedule for the August/September 1993 time frame.

This page intentionally left blank

17.0 Schedule

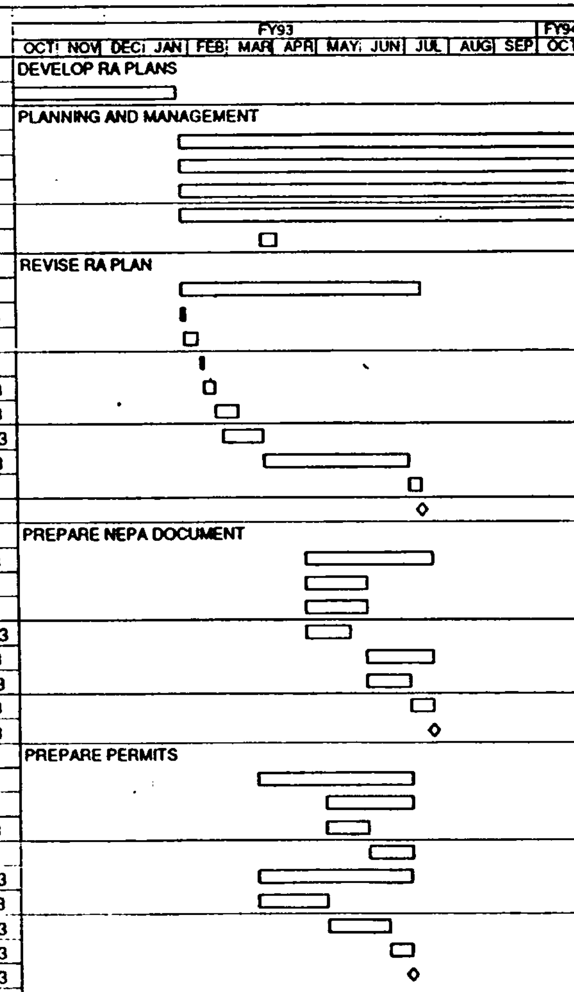
The Project Chariot: 1962 Tracer Study Site Assessment and Remedial Action project schedule is presented on Table 17-1. The on-site remediation and sampling activities are tentatively scheduled to commence in July 1993 and conclude in early September 1993. This schedule has been adopted in response to a written request submitted by the local populous, who have expressed concerns that any site activities conducted between the months of March and June may adversely impact the subsistence hunting season of local villages.

The implementation of the remedial action, in accordance with this schedule, is dependent on the following predecessor activities:

- NEPA evaluation by the USFWS
- Securing all federal, state, and local permits (e.g., USFWS Special Use Permit, and Wetlands Permit)
- Securing an Access Agreement from the Native Allotment holder
- Procurement of services and subcontractors in accordance with Federal Procurement Regulations.

Table 17-1
Project Chariot Target Schedule (Page 1 of 4)

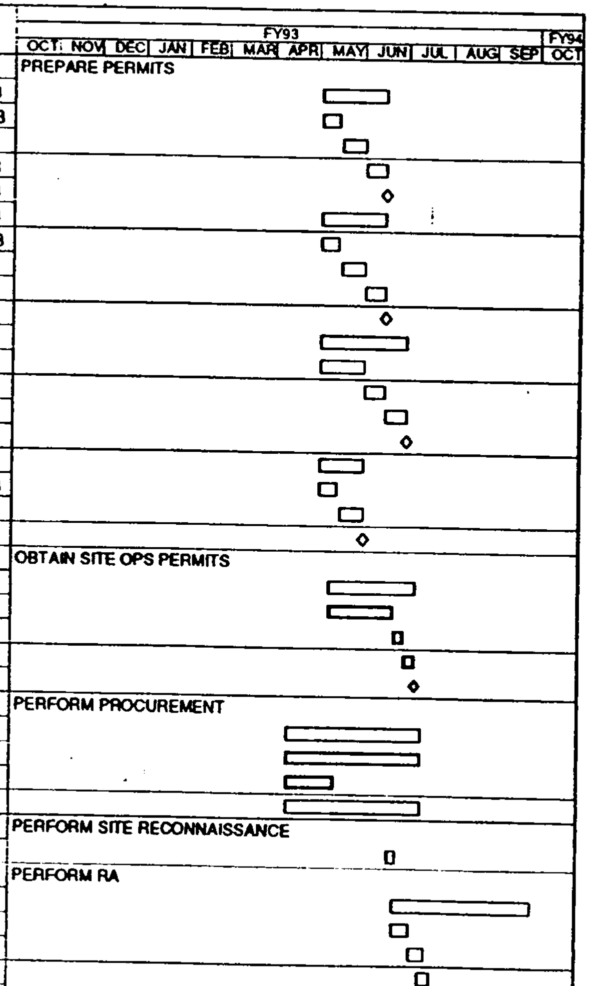
ACTIVITY ID	ACTIVITY DESCRIPTION	ORIG DUR	EARLY START	EARLY FINISH
	DEVELOP RA PLANS			
P210001000	Develop Remedial Action (RA) Plan	98	1SEP92	22JAN93
	PLANNING AND MANAGEMENT			
P210100000	Planning and Management	222	25JAN93	8DEC93
P210101000	Project Management	222	25JAN93	8DEC93
P210102000	Health and Safety	222	25JAN93	8DEC93
P210103000	Quality Assurance	222	25JAN93	8DEC93
P210104000	Regulatory Compliance Strategies	9	22MAR93	1APR93
	REVISE RA PLAN			
P220100000	Revise RA Plan	117	25JAN93	9JUL93
P220101000	DOE Review	3	25JAN93	27JAN93
P220102000	Address DOE Comments	8	27JAN93	5FEB93
P220103000	ADEC/USFWS Review	2	8FEB93	9FEB93
P220104000	Address ADEC/USFWS Comments	5	10FEB93	17FEB93
P220105000	Develop and Present RA Plan Summary	12	18FEB93	5MAR93
P220106000	Public Review	20	23FEB93	22MAR93
P220107000	Address Public Comments	71	23MAR93	30JUN93
P220108000	RA Plan Approval	6	1JUL93	9JUL93
P220108500	RA Plan Complete	0		9JUL93
	PREPARE NEPA DOCUMENT			
P220200000	NEPA	62	20APR93	16JUL93
P220201000	Prepare NEPA Documentation	30	20APR93	1JUN93
P220201001	Prepare EA (USFWS)	30	20APR93	1JUN93
P220201002	Prepare EA Transportation Analysis (IT)	23	20APR93	20MAY93
P220202000	Regulatory/Public Review	33	1JUN93	16JUL93
P220202001	Regulatory/Public Review	22	1JUN93	30JUN93
P220202002	Conduct Consultations	11	1JUL93	16JUL93
P220202501	EA Approval/FONSI Signed	0		16JUL93
	PREPARE PERMITS			
P220300000	Secure Permits	76	17MAR93	1JUL93
P220301000	Secure Site Access Agreement	43	3MAY93	1JUL93
P220301001	Negotiate Agreement	21	3MAY93	1JUN93
P220301002	Issue Site Access Agreement	22	2JUN93	1JUL93
P220302000	Secure COE Permit #38 Wetlands Permit	75	17MAR93	30JUN93
P220302001	Prepare Documentation	34	17MAR93	3MAY93
P220302002	Regulatory Review	30	4MAY93	15JUN93
P220302003	Address Comments	11	16JUN93	30JUN93
P220302502	Issue Wetlands Permit	0		30JUN93



U.S. DEPARTMENT OF ENERGY
PROJECT CHARIOT
TARGET SCHEDULE

Table 17-1
Project Chariot Target Schedule (Page 2 of 4)

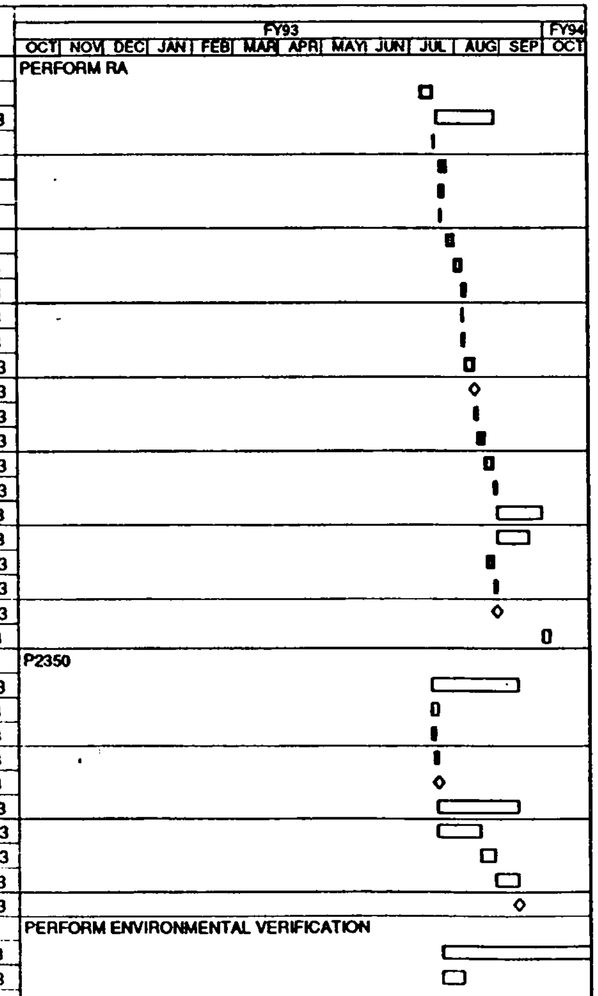
ACTIVITY ID	ACTIVITY DESCRIPTION	ORIG DUR	EARLY START	EARLY FINISH
P220303000	Secure USFWS Special Use Permit	31	3MAY93	15JUN93
P220303001	Prepare Application	10	3MAY93	14MAY93
P220303002	Regulatory Review	11	17MAY93	1JUN93
P220303003	Address Comments	10	2JUN93	15JUN93
P220303503	Issue Permit	0		15JUN93
P220304000	Secure Coastal Zone Management Permit	31	3MAY93	15JUN93
P220304001	Prepare Permit Application	10	3MAY93	14MAY93
P220304002	Regulatory Review	11	17MAY93	1JUN93
P220304003	Address Comments	10	2JUN93	15JUN93
P220304504	Issue Permit	0		15JUN93
P220305000	Secure DOE-Hanford Waste Acc. App.	42	3MAY93	30JUN93
P220305001	Prepare DOE Waste Acc. Criteria App.	21	3MAY93	1JUN93
P220305002	DOE-Hanford Review	10	2JUN93	15JUN93
P220305003	Address Comments	11	16JUN93	30JUN93
P220305505	Issue Approval	0		30JUN93
P220306000	Secure Land Management Regulation Permit	21	3MAY93	1JUN93
P220306001	Prepare Permit App.	10	3MAY93	14MAY93
P220306002	Address Comments	11	17MAY93	1JUN93
P220306506	Issue Permit	0		1JUN93
P220400000	Obtain Site Ops Permits	41	10MAY93	7JUL93
P220401000	Prepare Permit Applications	31	10MAY93	22JUN93
P220402000	Regulatory Review	5	23JUN93	29JUN93
P220403000	Address Comments	5	30JUN93	7JUL93
P220403507	Issue Permits	0		7JUL93
P220500000	Perform Procurement	64	12APR93	12JUL93
P220501000	Procure Services Support	64	12APR93	12JUL93
P220502000	Procure Subcontractors	25	12APR93	14MAY93
P220503000	Procure Equipment/Materials	64	12APR93	12JUL93
P220600000	Perform Site Reconnaissance	6	20JUN93	25JUN93
P230000000	Perform RA	95	24JUN93	28SEP93
P230001000	Barge Seattle to Anchorage	11	24JUN93	5JUL93
P230002000	Barge Anchorage to Job Site	11	6JUL93	16JUL93
P230004000	Mob/Demob Personnel & Training	9	12JUL93	20JUL93



U.S. DEPARTMENT OF ENERGY
PROJECT CHARIOT
TARGET SCHEDULE

Table 17-1
Project Chariot Target Schedule (Page 3 of 4)

ACTIVITY ID	ACTIVITY DESCRIPTION	ORIG DUR	EARLY START	EARLY FINISH
PERFORM RA				
P230005000	Set-up Camp	9	8JUL93	16JUL93
P230006000	Field Support	40	19JUL93	27AUG93
P230007000	Off-Load Barge	1	17JUL93	17JUL93
P230008000	Relocate Ops to Excavation Area	5	21JUL93	25JUL93
P230009000	Set-up Decon, EZ, CRZ & Erosion Control	3	21JUL93	23JUL93
P230010000	Layout Excavation	1	21JUL93	21JUL93
P230011000	Excavate/Stockpile Overburden	5	26JUL93	30JUL93
P230012000	Excavate/Load Soil in Containers	5	31JUL93	4AUG93
P230013000	Transfer Containers to Storage Area	3	5AUG93	7AUG93
P230014000	Perform Post-Excavation Sampling	1	5AUG93	5AUG93
P230015000	Perform Container Sampling	2	5AUG93	6AUG93
P230016000	Perform Lab Analysis/ADEC Approval	7	7AUG93	13AUG93
P230016508	Lab Analysis/ADEC Approval Complete	0		13AUG93
P230017000	Decon of Equipment	2	14AUG93	15AUG93
P230018000	Restore Excavation and Revegetation Area	5	16AUG93	20AUG93
P230019000	Return Ops to Base Camp	6	21AUG93	26AUG93
P230020000	Load out Ops on Barge	2	27AUG93	28AUG93
P230021000	Barge from Job Site to Seattle	30	29AUG93	28SEP93
P230022000	Ship Equipment & Supplies to Anchorage	21	29AUG93	19SEP93
P230023000	Dismantle Base Camp	5	22AUG93	26AUG93
P230024000	Demobilization	2	27AUG93	28AUG93
P230024509	Project Demobilization Complete	0		28AUG93
P230025000	Trucking - Seattle to Nevada	5	29SEP93	3OCT93
P2350				
P235000000	Perform Aerial Survey (EG&G)	59	14JUL93	11SEP93
P235001000	Survey Site	5	14JUL93	18JUL93
P235001001	Perform Aerial Survey	3	14JUL93	16JUL93
P235001002	Prepare Draft Data Submittal	3	16JUL93	18JUL93
P235001510	Submit Draft Data	0		18JUL93
P235002000	Prepare Study Report	55	18JUL93	11SEP93
P235002001	Prepare Draft Report	30	18JUL93	16AUG93
P235002002	DOE Review	10	17AUG93	26AUG93
P235002003	Address DOE Comments	15	27AUG93	11SEP93
P235002511	Submit Final Report	0		11SEP93
PERFORM ENVIRONMENTAL VERIFICATION				
P240000000	Perform Environmental Verification	131	21JUL93	1DEC93
P240001000	Perform Radiological Survey	15	21JUL93	4AUG93



U.S. DEPARTMENT OF ENERGY
PROJECT CHARIOT
TARGET SCHEDULE

Table 17-1
Project Chariot Target Schedule (Page 4 of 4)

ACTIVITY ID	ACTIVITY DESCRIPTION	ORIG DUR	EARLY START	EARLY FINISH
	PERFORM ENVIRONMENTAL VERIFICATION			
P240001001	Perform Plot Inspection	1	21JUL93	21JUL93
P240001002	Lay-out Grid	4	22JUL93	25JUL93
P240001003	Perform Rad Survey	7	26JUL93	1AUG93
P240001004	Excavate/Containerize Test Plots	1	2AUG93	2AUG93
P240001005	Re-Survey Test Plots	1	3AUG93	3AUG93
P240001006	Receive ADEC Closure Approval	1	4AUG93	4AUG93
P240001512	ADEC Closure Approval Complete	0		4AUG93
P240002000	Perform Surface Water/Sed. Sampling	29	21JUL93	18AUG93
P240002001	Establish Sampling Stations	14	21JUL93	3AUG93
P240002002	Sample Stations	9	3AUG93	11AUG93
P240002003	Analyze Samples	16	3AUG93	18AUG93
P240003000	Perform Biological Sampling	131	21JUL93	1DEC93
P240003001	Establish Sampling Stations	11	21JUL93	31JUL93
P240003002	Collect Biological Samples	96	1AUG93	5NOV93
P240003003	Analyze Biological Samples	106	15AUG93	1DEC93
	PROJECT CLOSE-OUT REPORT			
P250000000	Project Close-out Report	71	27AUG93	8DEC93
P250001000	Prepare Draft Report	21	27AUG93	27SEP93
P250002000	DOE Review	7	28SEP93	6OCT93
P250003000	Revise Draft Report	21	7OCT93	4NOV93
P250004000	ADEC Review	7	5NOV93	15NOV93
P250005000	Revise Draft Report	14	16NOV93	7DEC93
P250006000	Submit Final Report	0		7DEC93
P250007000	ADEC Approval of Final Report	1	8DEC93	8DEC93
P250007513	ADEC Approval of Final Report Complete	0		8DEC93

FY93: OCT NOV DEC JAN FEB MAR APR MAY JUN JUL AUG SEP | FY94: OCT

U.S. DEPARTMENT OF ENERGY
PROJECT CHARIOT
TARGET SCHEDULE

This page intentionally left blank

18.0 References

Alaska Division of Public Health, 1992, *Health Risk Assessment of Radioisotopes at Cape Thompson, Alaska.*

U.S. Department of Energy, Nevada Operations Office, 1993, "Quality Assurance," *NV 5700.6C,* Las Vegas, NV.

U.S. Department of Energy, 1993, "Quality Assurance," *DOE Order 5700.6C,12,* Washington, DC.

U.S. Department of Energy, Nevada Operations Office, 1991 "Quality Assurance Manual," *NV 57XB.1-11,* Las Vegas, NV.

U.S. Environmental Protection Agency, 1991, "Development of Risk-based Preliminary Remediation Goals," *Human Health Evaluation Manual, Part B,* Washington, DC.

U.S. Environmental Protection Agency, 1986, *Field Manual for Grid Sampling of PCB Spill Sites to Verify Cleanup*, EPA/560/5-86-107, Washington DC.

U.S. Environmental Protection Agency, 1988, *Standard Operating Safety Guides,* Washington, DC.

U.S. Environmental Protection Agency, 1987, *A Compendium of Superfund Field Operations Methods,* EPA/540/P-87/001, Washington DC.

U.S. Environmental Protection Agency, 1987, *Data Quality Objectives for Remedial Response Activities,* EPA/540/G-87-003, Washington DC.

U.S. Environmental Protection Agency, 1986, *Superfund Remedial Design and Remedial Action Guidance,* Washington, DC.

U.S. Environmental Protection Agency, 1985, *Remedial Actions at Waste Disposal Sites (Revised), Handbook,* EPA/625/6-85/006, Washington, DC.

Wilimovsky, N.J. and J.N. Wolfe, editors, 1966, *Environment of the Cape Thompson Region, Alaska,* U.S. Atomic Energy Commission, Division of Technical Information, Oak Ridge, Tennessee.

This page intentionally left blank

APPENDIX A

SAMPLING AND ANALYSIS PLAN

This page intentionally left blank

SAMPLING AND ANALYSIS PLAN

PART I

FIELD SAMPLING PLAN

This page intentionally left blank

APPENDIX A

SAMPLING AND ANALYSIS PLAN

FOR

PROJECT CHARIOT: 1962 TRACER STUDY
SITE ASSESSMENT AND REMEDIAL ACTION PLAN

PART 1

FIELD SAMPLING PLAN (FSP)

July 1993

This page intentionally left blank

Table of Contents

Table of Contents *(Continued)*

List of Tables

List of Figures

List of Abbreviations/Acronyms

ADFG	Alaska Department of Fish and Game
AEC	U.S. Atomic Energy Commission
Am-241	americium-241
CLP	Contract Laboratory Program
COC/RFA	Chain-of-Custody/Request for Analysis
cpm	counts per minute
Cs-137	cesium-137
DE	disposable equipment
DOE/NV	U.S. Department of Energy Nevada Operations Office
DOT	U.S. Department of Transportation
DQOs	Data Quality Objectives
EPA	U. S. Environmental Protection Agency
FSP	Field Sampling Plan
GPS	Global Positioning System
GS	gamma spectroscopy
HSM	Health and Safety Manager
IATA	Internal Air Transport Association
IDW	investigation-derived wastes
LLD	lower limit of detection
MCA	Multichannel Analyzer
MDAs	minimum detectable activities
NaI	sodium iodide
NTS	Nevada Test Site
PARCCs	precision, accuracy, representativeness, completeness, comparability
PCBs	polychlorinated biphenyls
pCi/g	picocurie per gram
PIC	pressurized ionization chamber
PPE	personal protective equipment
QA	Quality Assurance
QAPjP	Quality Assurance Project Plan
QC	Quality Control
RAS	routine analytical service

List of Abbreviations/Acronyms (Continued)

RCRA	Resource Conservation and Recovery Act
SAP	Sampling and Analysis Plan
SOP	Standard Operating Procedures
TCLP	Toxicity Characteristic Leaching Procedure
USGS	U.S. Geological Survey
μR/hr	microroentgen per hour

1.0 Introduction

The DOE Nevada Operations Office (DOE/NV) plans to conduct a remedial action of the Project Chariot: 1962 Tracer-Study-generated soil disposal mound and environmental verification of the tracer-study test plot areas. The Project Chariot Site is located near Cape Thompson, Alaska. This Sampling and Analysis Plan (SAP) is Appendix A to the Site Assessment and Remedial Action Plan, which has been prepared to address the Project Chariot: 1962 Tracer Study conducted at the Project Chariot Site.

The SAP is part of the functional working documents for the site assessment and remedial action. This SAP details the specifics of the procedures and documentation for each activity for the following environmental media: surface water and sediment, surface soil, and biota. The Field Sampling Plan (FSP) documents methods and procedures to be used for all the environmental media of concern listed above. The Quality Assurance Project Plan (QAPjP) documents the Quality Assurance (QA) and Quality Control (QC) procedures for all project activities. Standard Operating Procedures (SOPs) detail the methods to be used to implement the FSP and QAPjP.

1.1 Background

Project Chariot was an experimental part of the United States Atomic Energy Commission's (AEC) Plowshare Program to test the use of nuclear explosives for peaceful purposes. In 1958, the AEC authorized planning and studies for an experimental harbor excavation in Alaska using nuclear explosives. The primary purpose of this project was to investigate a nuclear-excavation technology. At the same time, other studies were underway using nuclear explosives, including a test called Sedan, a cratering experiment carried out at the Nevada Test Site (NTS).

The AEC, with the assistance of other agencies, university researchers, and the Canadian Government, conducted pretest environmental studies in the Cape Thompson area to allow adequate assessment of the effect of the proposed project and assure the safety of the environment. The AEC conducted more than 40 separate environmental investigations between 1959 and 1961. By 1962, much of the desired nuclear-excavation engineering data originally planned to be obtained in Project Chariot had become available from experiments at other sites. The AEC decided in 1962 to suspend Project Chariot and to end the associated environmental studies. No nuclear explosive devices were brought to the Project Chariot Site. Many of the environmental study results and site descriptions presented in this plan were published in 1966 in a book entitled *Environment of the Cape Thompson Region, Alaska* (Wilimovsky and Wolfe, 1966).

During the course of these environmental studies, the U.S. Geological Survey (USGS) under a license granted by the AEC carried out a six-day (August 20-25, 1962) radioactive tracer experiment on the soils at the Project Chariot Site. The purpose of this experiment was to measure overland transport of certain radioactive tracers at the site. Small quantities of radioactive tracer material and approximately 6.8 kilograms (kg) (15 pounds [lb]) of soil containing radioactive fallout from the Sedan cratering experiment at the NTS were used for the tests. Measurements were then at 12 plots, which were specifically designed to represent a variety of microdrainage patterns. All 12 test plots were adjacent to the headwater forks of Snowbank Creek, about 2.6 kilometers (km) (1.6 miles [mi]) north-northwest from the base camp. The test plots ranged in size from 0.6 by 0.6 meters (m) (2 by 2 feet [ft]) to 1.5 by 2.1 m (5 by 7 ft). The following types and activities of the radioisotopes were used:

Radioisotope	**Activity** (At the time of the test)
Cesium-137 (Cs-137)	2×10^8 becquerels (6 millicuries)
Iodine-131 (I-131)	2×10^8 becquerels (5 millicuries)
Strontium-85 (Sr-85)	2×10^8 becquerels (5 millicuries)
Project Sedan fallout	4×10^8 becquerels (10 millicuries)

In general, overland and underground transport tracer studies were performed at the Project Chariot Site to determine the migration potential of radionuclides via surface runoff and percolation or infiltration of water in the soil. A detailed description of the experiments conducted at the Project Chariot Site are presented in Chapter 2.2 of this Site Assessment and Remedial Action Plan (RAP).

The half-lives of I-131 and Sr-85 are less than 70 days. Therefore, both of these isotopes have essentially decayed away leaving only Cs-137 and the Sedan fallout. Since test plots 109, 110, 111, and 112 were used for only I-131 tracer studies, they have been eliminated from further radiological soil sampling.

The sediment transport experiment, performed directly into Tributary No. 3 of Snowbank Creek, will be assessed during the surface water and sediment sampling and analysis tasks. Based on the interviews and photographs taken in 1962 during the soil disposal mound formation, test plots 113 and 114 were believed to be located directly under the soil disposal mound and will be addressed during the mound sampling activities. Test plots 105, 106, 107, 115, and 116, which were positioned along Snowbank Creek, will be assessed during the radiological ground survey (Figure 1-1).

The sampling and analysis tasks for the remedial action have been organized into three discrete elements:

- Environmental Verification (Section 2.0 of this FSP)
- Excavation Site Surveying and Sampling (Section 3.0)
- Biological Sampling (Section 4.0).

The sampling and analysis tasks to be performed as part of the Environmental Verification element have been designed to address the areas where the Project Chariot: 1962 Tracer Study was conducted. Tasks to be performed include:

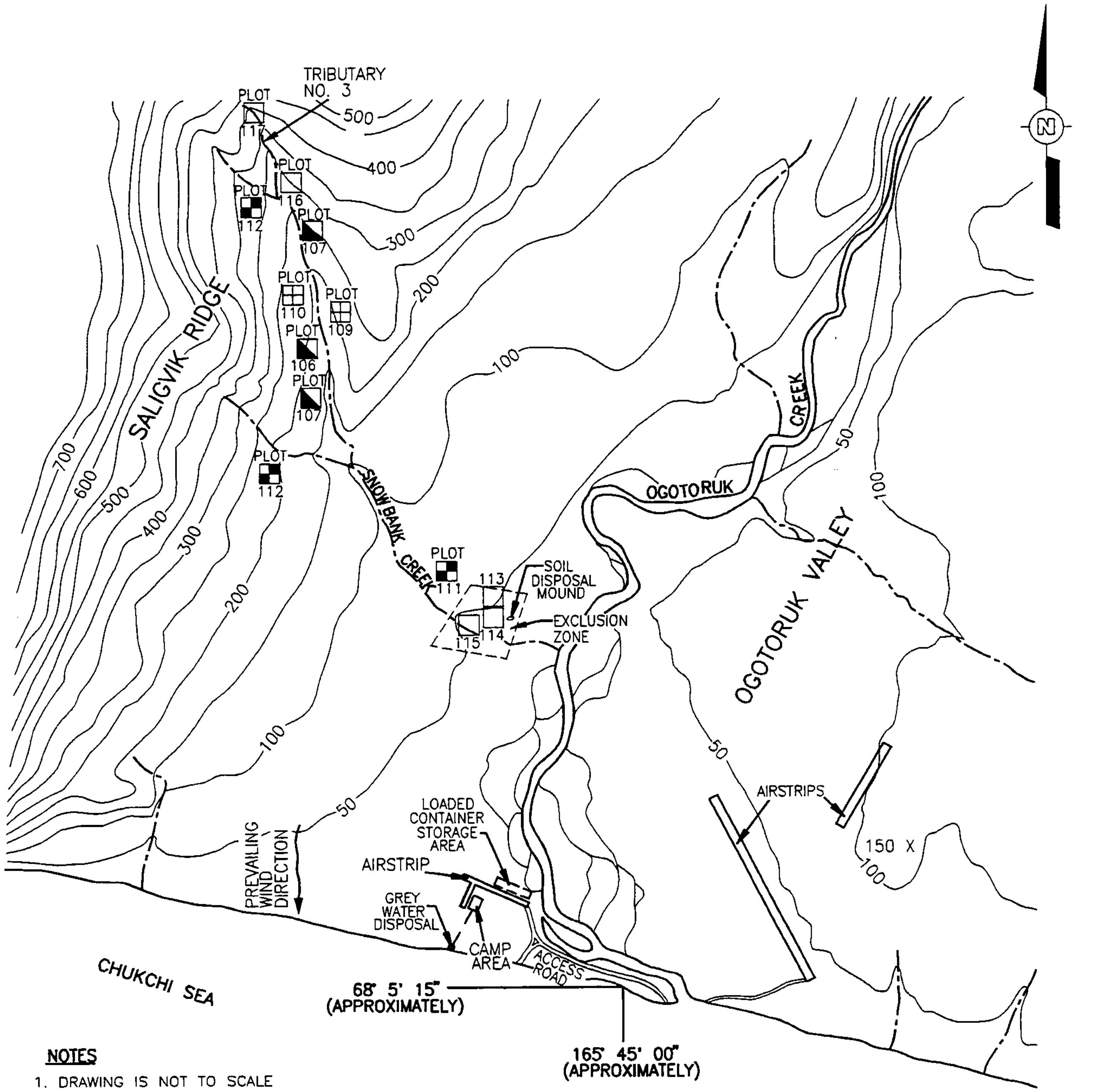
- Radiological survey of the test plot areas

- Surface water and sediment sampling and analysis of Snowbank Creek, Ogotoruk Creek, and Snowbank Creek Tributary No. 3.

The sampling and analysis tasks to be performed in conjunction with the remediation of the tracer-study soil disposal mound include the following:

- Soil disposal mound characterization sampling and analysis
- Background soil sampling and analysis
- Post-excavation sampling and analysis.

It is expected that the soil disposal mound will be removed, characterized, packaged, shipped, and disposed as waste at the Nevada Test Site (NTS). The sampling and analysis requirements presented in the SAP meet the NTS stringent applicable waste acceptance criteria.



NOTES

1. DRAWING IS NOT TO SCALE
2. FIGURE ILLUSTRATES TENATIVE LOCATIONS OF BASE CAMP AND ASSOCIATED SUPPORT FACILITIES.

LEGEND

- SEDAN SOIL
- CESIUM – 137
- IODINE – 131
- STRONTIUM – 85
- 100 CONTOUR LINES – 50 FOOT INTERVALS
- CREEKS

REFERENCE: INFORMATION TAKEN FROM PLATE I, TOPOGRAPHIC MAP OF PART OF CAPE THOMPSON REGION, NORTHWESTERN ALASKA, DATED 1965.

FIGURE 1–1
RADIOISOTOPE
TEST PLOT LOCATIONS

DRAWN BY	R. BATES	CHECKED BY		DRAWING NUMBER	301971.201.07
	06/28/93	APPROVED BY			

CHARA30 07/02/93 10:00AM JRB

The sampling and analysis tasks to be performed in conjunction with the Biological Sampling effort include:

- Lichen sampling and analysis
- Vascular plant sampling and analysis
- Shrub sampling and analysis
- Mammal sampling and analysis.

These planned field activities will be performed in order to achieve the objectives of the RAP.

1.2 Purpose and Objectives

The purpose of this SAP is to guide the conduct of the DOE/NV, participating organizations, and contractors that will implement the field activities; to ensure that sampling and data collection activities will result in representative and defensible data; and to provide a mechanism for planning and approving the field activities.

The objectives of the SAP are to (1) define procedural and documentation requirements for all data collection activities that will be conducted during the remedial action, (2) define the QA requirements for all data collected and tests and analyses performed, and (3) serve as a working document for use by field sampling personnel at the site.

1.3 Contents

This SAP consists of three discrete parts: Part 1 is the FSP, Part 2 is the QAPjP, and Part 3 is the SOPs. The FSP documents the methods and procedures to be used in conducting field work for all environmental media of concern. The QAPjP documents the QA and QC procedures that will be followed during all field activities. The QAPjP ensures that usable and defensible data are collected and that accurate and reproducible tests and analyses are conducted during the course of the remediation. The SOPs detail the procedures to be followed while performing the investigations and sampling tasks.

1.4 Field Sampling Plan Objective

The objective of this FSP is to ensure that all field activities conducted will result in the collection of representative and defensible data. The FSP is intended to serve as a discrete part of the SAP.

While this FSP contains much information that is also presented in Sections 2.0, 3.0, 9.0, 10.0, 11.0, 14.0, and 17.0 of the RAP (e.g., the descriptions of the site and areas of concern), the user should be familiar with the entire RAP. Section 17.0 of the RAP presents the project schedule for implementing the field activities detailed in the FSP. The Health and Safety Plan for the conduct of all field activities at the site during the field effort is provided in Appendix B of the RAP.

1.5 FSP Organization

The sampling procedures and objectives for the Environmental Verification, the Excavation Site Surveying and Sampling, and the Biological Sampling are discussed and detailed in Section 2.0, 3.0, and 4.0 of this FSP, respectively. Section 5.0 discusses the interim control of investigation-derived wastes (IDW). Section 6.0 outlines the sample handling and presentation procedures. Section 7.0 discusses the laboratory analysis of samples collected during the Project. Detailed procedures for these activities are provided in the SOPs. Table 1-1 is a list of the SOPs for the field activities.

1.6 Project Data Quality Objectives

Data Quality Objectives (DQOs) are established for the project to ensure that the data collected are sufficient and of adequate quality for their intended use. The DQOs for this project have been established using the Environmental Protection Agency's (EPA's) three-step DQO process (EPA,1987). Data quality factors considered in the development of DQOs include defined appropriate analytical levels, prioritized data uses, radiological isotopes of potential concern, and required detection limits.

The analytical levels, described in *Data Quality Objectives for Remedial Response Activities,* (EPA, 1987) are defined as follows:

- Level I - field screening or analysis using portable instruments. Results are often not compound-specific and not quantitative, but results are available in real-time.

- Level II - field analysis using more sophisticated portable instruments; in some cases, the instruments may be set up in a mobile laboratory on-site. There is a wide range in the quality of data that can be generated, depending on the use of suitable calibration standards, reference materials, and sample preparation equipment and on the training of the operator. Results are available in real-time or in several hours.

Table 1-1
Standard Operating Procedures (SOPs)

SOP#	Title
CHR-01	Sample Control and Documentation
CHR-02	General Field Instructions
CHR-03	Walkover Surveys Using a Large Volume Scintillation Detector
CHR-04	Field Decontamination
CHR-05	Shipment of Remedial Action Derived Waste
CHR-06	Field Activity Photographs
CHR-07	Sediment Sampling
CHR-08	Surface Water Sampling
CHR-09	Shipment of Samples
CHR-10	Surface Soil Sampling
CHR-11	Exposure Rate Measurements Using a PIC
CHR-12	Visual Inspection and Documentation of Test Plots
CHR-13	Radiation Survey of Test Plots
CHR-14	Operation of Multichannel Analyzer
CHR-15	Operation of Mobile Sodium-Iodide Detector System
CHR-16	Determination of Lower Limits of Detection
CHR-17	Correlation of Sodium Iodide Readings with Pressurized Ion Chamber
CHR-18	Daily Source and Background Checks
CHR-19	Establishment of a Hexagonal Grid System
CHR-20	Small Mammal Sampling
CHR-21	Ptarmigan Sampling
CHR-22	Selection of Background Sampling Locations
CHR-23	Operation of the Global Positioning System
CHR-24	Vegetation Sampling
CHR-25	Fish Sampling
CHR-26	Smear Sample Collection and Analysis
CHR-27	Operation of the Geiger-Mueller (Pancake) Detector and Survey Meter
CHR-28	Operation of the Alpha Scintillation Probe and Count Rate Meter
CHR-29	Horiba U-10® Water Quality Check
CHR-30	Splitting Samples

- Level III - all analyses performed in an off-site analytical laboratory. Level III analyses may or may not use Contract Laboratory Program (CLP) procedures, but do not usually utilize the validation or documentation procedures of CLP Level IV analysis. The laboratory may or may not be a CLP laboratory.

- Level IV - CLP routine analytical services (RAS). All analyses are performed in an off-site analytical laboratory following CLP protocols. Level IV is characterized by rigorous QA/QC protocols, data validation, and documentation.

- Level V - analysis by nonstandard methods. All analyses are performed in an off-site analytical laboratory, which may or may not be a CLP laboratory. Method development or method modification may be required for specific constituents or detection limits. CLP special analytical services are Level V.

Levels I, II, and V analytical requirements will be employed for the sediment and surface water and for the mound sampling activities. Level V will be used for verification of on-site radiological analyses and Level IV for RCRA analyses of waste characterization samples. The off-site laboratory will conduct confirmatory analyses for gross alpha, gross beta, gamma spectra, Cs-137, Am-241, and Pu-239. RCRA analyses will include volatiles, semivolatiles, metals, polychlorinated biphenyls (PCBs), and free liquids to ensure that the most stringent waste acceptance criteria are met. Samples will be submitted to the IT Analytical Services laboratory in St. Louis, Missouri.

1.7 Project Site-Wide Activities

The following general site-wide activities apply to all operations and sampling and analysis actions that are conducted on-site:

- All safety equipment and action-levels will be specified by the Health and Safety Officer (HSO) and will be referenced in the project Health and Safety Plan. Caution will be employed to avoid accidents due to potential unstable footing in the streams and to avoid unnecessary confrontations with bears. Only necessary personnel will remain in the near vicinity during sampling activities.

- A sample collection log will be kept during the sampling efforts noting the following information: sample location; split/duplicate interval; date/time of sample collection; sampler's name; any unusual occurrences (visual and/or physical); sample description; field conditions (e.g., temperature and weather); any and all field survey radiation measurements recorded by the HSO; and work progress. Documentation of all field activities (including sampling, handling, and disposition of equipment) will be recorded in the field and/or sample collection logs using indelible black ink. A detailed description of record keeping procedures is provided in SOP-CHR-01 and SOP-CHR-02.

1.8 Environmental Sampling

The environmental sampling includes an aerial photographic survey, an aerial radiological survey, ground surveys, surface water, sediment, and biota sampling.

The aerial photographic survey will be done before site activities begin. Surveys of the test plots and disposal mound will be taken using a Convair 580 aircraft at 900 m (3,000 ft) above land surface. A photographic survey of the old landing field and creek areas will be taken at an elevation of 2,700 m (9,000 ft). A general survey photograph of the area will be taken at 7,600 m (25,000 ft). Data from the radiological survey will be plotted on the general survey photograph.

The aerial photographic surveys will be taken using a Wield Aerial camera, Model RC-10 vertical aerial camera, which produces 23 by 23-centimeter (cm) (9 by 9-inch [in.]) negatives. The photographs will be taken using three types of film: Kodak Aero Color film, normal color film, and false color IR film. The photographs will also be used to assist in the evaluation of the condition of the Project Chariot landing field, base camp, and tracer-study disposal mound. In addition, the photographs may show damage to the tundra, which could indicate the location of the old test plots.

An aerial radiological survey will follow the photographic survey. The radiological survey will use a sodium iodide (NaI) detector system mounted in a helicopter. The survey will be conducted on a grid system and will cover the Ogotoruk Valley and the Kisimilok Valley. Anomalies will be verified through the use of ground surveys. Additionally, ground surveys will be conducted to verify results of the aerial radiological survey and to investigate the tracer-study test plots and other disturbed areas.

Surface water and sediment samples will be taken from Snowbank and Ogotoruk Creeks and an ephemeral pond adjacent to the soil disposal mound. Sampling stations will be established and one surface water and one sediment sample will be taken from each station.

The soil disposal mound will be surveyed, sampled, excavated, and packaged as waste. The soil disposal mound is covered with native soil; this soil will be used to backfill the excavation if sample results indicate the soil is not radiologically contaminated.

Biota sampling of the flora and fauna indigenous to the Ogotoruk and Kisimilok Valleys will be part of the wide-reached activities. This sampling will be representative of the area and emphasize species of concern to the local population.

2.0 Environmental Verification

The proposed tasks for the site assessment and remedial action Environmental Verification are as follows: (1) perform an aerial photographic and gamma survey; (2) sample and analyze surface water and sediments (from Ogotoruk Creek and Snowbank Creek); and (3) conduct a radiological ground survey of the tracer test plots.

As part of the experiments conducted at the Project Chariot Site, overland transport studies were conducted on 10 test plots adjacent to Snowbank Creek. Underground transport of radionuclides was studied using a percolation test on a hillside above Snowbank Creek. In addition, a sediment transport experiment was also conducted on a small tributary of Snowbank Creek. As a result of these experiments, residual radionuclides may have been deposited in the stream sediments and/or remained on the hillside where the tests were conducted . Therefore, samples of the sediment and water will be collected and analyzed downstream of the experiment site.

2.1 Sampling Objectives

The objectives of the Environmental Verification sampling activities are to locate the original test plot sites from the Project Chariot: 1962 Tracer Study; determine if any residual isotopes remain in the vicinity of the test plots and/or the stream sediments; and if so, determine if the levels pose a potential concern to human health and the environment. Soil will be removed that exceeds the 0.4 becquerels per gram (Bq/g) (10 picocuries per gram [pCi/g]) limit set for consistency with "as low as reasonably achievable" (ALARA) principles (see also Appendix C of the RAP, Risk Analysis). In order to fulfill these sampling objectives, the proposed tasks for the environmental characterization are as follows:

- Conduct aerial radiological surveys of Ogotoruk Valley to screen the valley for the potential existence of unnaturally elevated levels of radioactivity resulting from the Project Chariot: 1962 Tracer Study

- Collect surface radiological survey data from the Project Chariot: 1962 Tracer Study test plots to locate the original experiment test plot sites, determine if residual radioisotopes remain, and if so, determine whether the levels present pose a concern with regard to exposure to either human or environmental receptors

- Collect composite background soil samples from three undisturbed locations in Ogotoruk Valley that display soil and vegetation characteristics similar to the soil disposal mound. The background soil samples will be collected to: (1) determine the naturally occurring background levels of radioactivity in order to allow for a distinction to be made between "clean" overburden soil and soil that requires removal to an appropriately licensed facility; and (2) to assist the surface radiological survey on locating the tracer-study test plot locations

- Collect representative surface water and sediment samples from Snowbank Creek and Ogotoruk Creek and the ephemeral pond adjacent to the soil disposal mound to determine if residual tracer-study isotopes remain, and if so, whether the levels pose an exposure concern to either human or environmental receptors

- Collect and analyze sediment samples as necessary for waste characterization purposes if other analyses show that sediment must be excavated and disposed of as waste.

The DQO method described in Section 1.6 will be employed to ensure that sampling objectives are met and that data obtained are verifiable. Levels I, II and V analytical requirements will be employed for the site characterization sampling activities. An on-site laboratory, field screening methods, and an off-site laboratory (for confirmatory analyses) will be used for radiological analyses. Additional radiological and hazardous waste constituent analyses required for waste disposal purposes will be conducted at an off-site laboratory requiring levels III and V. The DQOs for the sampling and analytical program are presented in Table 2-1. Sediment and surface water sampling will be performed in accordance with SOP-CHR-07 and SOP-CHR-08.

The sampling program will be conducted in several stages. First, an aerial photographic survey at approximately 7,600 m (25,000 ft) will be conducted in June 1993. Then, an aerial radiological survey will be conducted from July 15 through July 25, 1993, on a grid system throughout the Ogotoruk Valley and a 5.0-square kilometer (km^2) (2-square mile [mi^2]) area of Kisimilok Valley. Ground surveys will then be conducted. A total of 21 environmental sampling stations will be established for collection of surface water and sediment samples from Snowbank and Ogotoruk Creeks, as well as the ephemeral pond adjacent to the soil disposal mound. Concurrent with the water and sediment and soil sampling, a radiological survey will be conducted of areas along either side of the creeks.

Table 2-1
Data Quality Objectives for Project Chariot Surface Water and Sediments, and Radiological Measurements

Sampling Type Activity	Data Objective[a]	Analytical Quality Level	Analyses	Required Detection Limits
Environmental Verification:				
Stream Sediment Samples	1	Level II,[b] Level V[c]	Gamma Spec RAD[c]	QAPjP required detection limits
Surface Water Samples	1	Level II[b] Level V[c]	Gamma Spec RAD[c]	QAPjP required detection limits
Radiological Survey (Plots)	2	Level I[c]	Gamma Spec	QAPjP required detection limits
Waste Sampling	3	Level V[c] Level III	RAD[d] EPA[e]	QAPjP required detection limits EPA required detection limits

[a]Data Objectives are:
(1) Determine presence/absence of radioisotopes of concern (on-site lab analysis for gamma spectroscopy, off-site lab analysis for gross-alpha and gross-beta analysis and gamma spectroscopy
(2) Determine presence/absence of gamma emitting radioisotopes of concern (on-site screening)
(3) Characterize materials that are classified as waste.

[b]On-site lab
[c]Off-site lab
[d]RAD includes gross alpha, gross beta, and gamma spectroscopy
[e]EPA - Environmental Protection Agency Methods for PCBs and total organics, inorganics, and metals.

A visual inspection of the Project Chariot Site will be conducted, and background samples will be collected. Background sampling procedures are provided in Section 3.3 and SOP-CHR-22. A visual inspection will be conducted to determine if the original test plots can be located; a grid will be established along the Snowbank and Ogotoruk Creeks and the grid will be field surveyed. Anomalies will be resurveyed and confirmatory sampling will be conducted. If it is determined that the anomalies are, indeed, above established levels, the anomalies will be excavated, characterized, and disposed of as waste. Each of these activities is described in the following sections.

2.2 Aerial Gamma Survey

Screening of the Ogotoruk Valley for the potential existence of unnaturally elevated levels of radioactivity resulting from the Project Chariot: 1962 Tracer Study will be conducted using an Aerial Gamma Survey. The survey will be conducted over (1) a 93-km^2 (36-mi^2) area centered on the Ogotoruk Valley and the Project Chariot Site and (2) a 5-km^2 (2-mi^2) background area approximately 10 km (6 mi) southeast of the primary area adjacent to the Kisimilok Creek Corridor. These areas are depicted on Figure P-2 of Appendix D of the RAP. The survey will be conducted by collecting gamma radiation data each second of the flight using an NaI scintillation crystal detector package mounted on an MBB BO-105 helicopter.

The helicopter will be flown at an altitude of 46 m (150 ft) over parallel flight paths spaced 76 m (250 ft) apart. The helicopter will be flown at a speed of 70 nautical miles per hour (knots) (80 miles per hour [mph]). Data collection flight time is estimated to be 5 hours. Steering along the pre-programmed flight lines will be accomplished using the Global Positioning System (GPS). The two flight patterns will include about 120 flight lines, about 88 14.5-km (9-mi) lines in the primary survey area (Ogotoruk Valley/Chariot), and 20 3.2-km (2-mi) lines in the background area (Kisimilok Creek).

The primary effort will be to map the Cs-137 activity. The detector package will have minimum detectable activities (MDAs) for Cs-137 as follows:

- 2,600 Bq/m^2 (0.07 $\mu Ci/m^2$) — uniform surface plane distribution
- 0.04 Bq/g (1 pCi/g) — exponentially distributed in the soil with relaxation depth = 10 cm and soil sample depth = 10 cm
- 0.04 Bq/g (1 pCi/g) — uniformly distributed with soil depth
- 4 x 10^7 Bq (1 mCi) — point source.

The activities to be conducted for the aerial radiological survey are described below.

- The initial setup activities will include:

- Establish base of operations at Northwestern Aviation, the Fixed Base Operation (FBO) at the Kotzebue airport to be used for the survey. Both helicopter operations and data reduction will be based out of this FBO.

- Conduct calibration/characterization of the gamma ray detectors.

  1. Calibrate the detectors and on-board acquisition system with NIST traceable sources, Cs-137, Am-241, and Na-22. This calibrates the system to sense gamma ray energies from 40 keV to 3000 keV (i.e., that range of energies for most natural and manmade sources).

  2. Conduct a pre-survey data acquisition flight over a predetermined test area (land and water) near Kotzebue at the planned survey altitude. The data from this flight will be used to insure that each part of the acquisition system is functioning properly.

     NOTE: Step 2 will be completed in Kotzebue initially to insure that the aircraft and system are ready prior to the Chariot site flights. A test line will be chosen at the survey site to be reflown at the beginning and end of each flight to ensure data integrity.

- Confirm Global Positioning System

  1. GPS coverage windows will be confirmed on a daily basis. Modes of the GPS satellites may be such that there are brief periods when no coverage is available. Flights will be planned around these windows.

  2. The GPS will undergo ground-based and aerial checks at Kotzebue for performance verification.

  3. GPS position data will be collected over visible land marks (trails, etc.) at the Chariot site, converted, and scaled to overlay an area map or photo that will be used as the base for the radiation contours.

• Data collection parameters and equipment for the gamma radiation survey are as follows:

  - Survey altitude: 46 m (150 ft)

  - Line spacing: 76 m (250 ft)

  - Helicopter speed: 70 knots (80 mph)

  - Area sizes: 93 km^2 (36 mi^2 [9 by 4 mi]) and 5 km^2 (2 mi^2)

- Total lines — 110 (88 at 14.5-km [9-mi] and 22 at 1.6-km [1-mi] lengths)

- Line miles — 814

- Total flight hours — 100 (includes 25 hours survey plus 60 hour round trip from the Las Vegas Office and 15 hours round trip Kotzebue to Chariot)

- Area restrictions — 0.8 km (0.5 mi) separation required from Paragon falcon's nest at Crowbill Point

- Eight 2 by 4 by 16 in.-NaI detector packages

- Minimum detectable activities for Cs-137 with this system are:

  - Point Source — 4×10^7 Bq (1 mCi)
  - Surface — 2,600 Bq/m^2 (0.07 $\mu Ci/m^2$)
  - Exponential $\alpha = .1$ and soil sample depth = 1 cm — 0.04 Bq/g (1 pCi/g)
  - Uniformly distributed with depth — 0.04 Bq/g (1 pCi/g)

- Gamma radiation data will be collected and analyzed from 88 flight lines over a 93-km^2 (36-mi^2) area centered on the Ogotoruk Valley and 22 flight lines over a 5-km^2 (2-mi^2) background area near the Kisimilok Creek.

  - Two 2.2 hour data collection flights will be conducted and the data processed (about 3 hours for each 2.2 hour flight) in 10 hour periods until the mission is complete, using a five man crew as follows:

    - Aircrew
      - 1 Pilot
      - 1 Electronic Technician
      - 1 Mechanic.

    - Ground crew:
      - 1 data analyst
      - 1 scientist.

  - The sequence of flights to collect the data will proceed as follows:

    The initial aircraft and crew will proceed to the site, from Kotzebue, land, refuel, and conduct an area recon flight to establish:

    - Bench marks
    - Visible landmarks

- Ground-based GPS station location
- Flight obstacles and hazards.

Once the recon information is evaluated, the flight hazards map will be updated and the GPS station properly located. All other data acquisition flights to cover the two areas of interest will be conducted as follows:

1. Test line at the beginning of the flight (land and water)

2. Programmed flight lines

3. Test line flight (land and water) at the end of the flight

4. Land, crew rest, and aircraft refuel (1 hour)

5. Second flight same steps as 1 through 4

6. Fly to Point Hope for crew exchange

7. During the survey flights, radiological data (multi-channel spectra), GPS position data, aircraft parameters (speed, clock time, altitude, etc.), and meteorological data will be recorded each second of flight onto magnetic tape cartridges for transfer and final analysis on a mini-computer system based in Kotzebue.

Aircrew and data transfer will occur at Point Hope; a Northwestern Aviation aircraft will be rented to ferry the crews between Point Hope and the FBO at Kotzebue, Alaska.

- The data will be archived, processed, and analyzed at the Kotzebue FBO as follows:

  - The data will be transferred from cartridges to mini system hard drives and backed up on magnetic cartridge tapes for permanent storage.

  - The multi-channel spectral data will be processed for data integrity and systems operation according to appropriate standard data quality checklists.

  - Data results will be generated in the form of isocount-rate contour maps with estimates of activity as per DOE request. These contour maps will be the primary means of identifying the locations of possible anomalies. Gamma-ray energy spectra will be generated to identify the source of any anomaly.

- Based on the sources used in the experiment at the Chariot site, isocount rate contour maps will be generated for:

  1. Total terrestrial gamma count rate plus Cosmic radiation (gross Count Rate), that is, count rates from gamma rays with energies between 40 keV and 3000 keV.

     NOTE: The gross count rate contour map is primarily used for data quality checks and to a lesser extent to locate anomalies.

  2. Total terrestrial manmade count rate (i.e., count rates due to gamma rays from manmade sources) with energies from 40 keV to 1400 keV. All gamma emitting sources used in the experiment fall in this energy range.

- It is likely that Cs-137 will be detected in the area, at least that due to worldwide fallout. Therefore, Cs-137 contour maps will be generated for total Cs-137 (worldwide fallout plus that above fallout) and Cs-137 above worldwide fallout:

  - The data will be processed completely. The data processing and analysis should be completed about one to two days after the survey flights are finished.

  - Reflys of data lines will be done according to steps previously described if reflys are necessary.

- The daily operation will consist of the following sequence of events:

  - Crew briefing

  - System warmup and calibration

  - Flight plan preparation

  - Mission, flight, and safety briefing

  - Helicopter launch for two flights at the site thus beginning the first shift

  - Second crew launch via Northwestern Aviation for Point Hope crew exchange

  - First crew and data return to Kotzebue for data transfer and crew rest

  - Second crew completes two flights and returns with helicopter to Kotzebue for data transfer and crew rest

  - Kotzebue FBO personnel will rotate with flight crews with about one hour overlap

- This cycle will be repeated until the data collection task is finished, and a previous day's status report will be faxed daily to the Las Vegas Office by 10:00 each day, local time.

Final data processing will occur in Las Vegas after return of all data.

2.3 Surface Water Sampling

Surface water at the site is drained by several small tributaries flowing into Snowbank Creek, which inturn, flows into the Ogotoruk Creek. There is also an ephemeral pond located adjacent to the disposal mound. The aquatic environments of concern at the Project Chariot Site will include: Snowbank Creek; Tributary No. 3 of Snowbank Creek; Ogotoruk Creek; and the unnamed ephemeral pond.

Tentative sample station locations on each of the waterbodies will be selected based on the June, 1993 field reconnaissance. Station locations may then be refined during investigations based on the actual field conditions encountered. The selected stations will be flagged with pin flags and/or flagging tape. Sample locations will be determined and verified by GPS field survey (SOP-CHR-23, Global Positioning System). All locations will be recorded on maps generated from USGS topographic quadrangle maps. Sampling activities will be recorded with photographs (SOP-CHR-06, Field Activity Photographs).

During the surface water investigation, the physical characteristics of the creeks sections and pond will be documented in a bound field notebook, FADLs, and on field survey maps (SOP-CHR-01). Descriptive parameters such as creek width, pond size (where applicable), color, turbidity, flow rate, bank vegetation, emergent vegetation, available fish cover, and bottom substrate will be recorded on the field data sheets. A Horiba water quality checker will be used to obtain the following in situ parameters:

- pH
- Dissolved Oxygen
- Conductivity
- Temperature
- Depth

A Marsh McBirney flowmeter will be utilized to take current velocity in each creek. Velocity will be taken at 1-m (3-ft) intervals across the surface water body at near bottom.

Water quality measurements will be taken at two locations in the ephemeral pond, and on selected creek sections at each of the stations.

Representative samples of the surface water will be collected in accordance with SOP-CHR-08 and will achieve the project-specific DQOs listed in Section 1.6. Discrete grab samples will be collected and submitted for analysis both to the on-site and off-site laboratories. If required, split samples will be collected as described in SOP-CHR-30. The sample bottles will be labelled using an alpha-numeric code. Field blank samples will be collected at a rate of one a day per sampling crew. Blind duplicate samples will be collected for quality control at a minimum of one for every 20 samples collected. Quality control samples will be collected in accordance with the procedure listed in the QAPjP. Due to the remoteness of the site, collected samples will be collected and one of each pair archived on-site to serve as backup, if necessary.

2.3.1 Location/Frequency

Surface water samples will be collected at nineteen creek stations and two stations within the pond (Table 2-2). Sample collection stations will be located as close as possible to the original test plot locations in order to determine if residual tracer material exists. However, locations may be changed based on the actual field conditions (i.e., availability of surface water).

The following samples will be collected from Snowbank creek, Tributary No. 3, Ogotoruk Creek, and the ephemeral pond:

- Seven samples from Snowbank Creek. These stations will start at the confines of Tributary No. 3 and Snowbank Creek. Each station will be located approximately equally distant apart moving downstream towards Ogotoruk Creek. (Note: the first station of this series will actually be located in Tributary No. 2 upstream and adjacent to the confines of Tributary No. 3 and Snowbank creeks.)

- Seven samples from Tributary No. 3. these stations will start at the headwaters of Snowbank Creek on Tributary No. 3 and run downstream to the confines of Tributary No. 3 and Snowbank Creek. Each station will be located equally distant, no stations are expected to be more than 100 m (330 ft) or less than 10 m (30 ft) apart moving downstream towards Snowbank Creek.

Table 2-2
Sample Location, Analysis, and Frequency of Surface Water and Sediment Samples

Sample Location	Sample Medium	Analysis	Quantity	Blanks	Duplicates	Sample Identification Code
SnowBank Creek	Surface Water Sediment	RAD[a] RAD	7 7	1 1	1 1	SBC-SW SBC-SD
Tributary #3 of Snowbank Creek	Surface Water Sediment	RAD RAD	7 7	1 1	1 1	T3-SW T3-SD
Ogotoruk Creek	Surface Water Sediment	RAD RAD	5 5	1 1	1 1	OC-SW OC-SD
Ephemeral Pond	Surface Water Sediment	RAD RAD	2 2	1 1	1 1	EP-SW EP-SD

[a] RAD includes gross alpha, gross beta, and gamma spectroscopy.

- Five samples from Ogotoruk Creek. These stations will include two stations located approximately 500 and 1,000 m (1,640 and 3,280 ft) upstream of the confines of Snowbank and Ogotoruk creeks. One station at the confines of Snowbank and Ogotoruk creeks, and two stations approximately 500 and 1,000 m (1,640 and 3,280 ft) downstream of the confines of Snowbank and Ogotoruk creeks.

- Two samples from the ephemeral pond. These stations will be located at each end of the pond.

Anticipated locations of the sampling stations are shown on Figure P-2 in Appendix D of the RAP.

2.3.2 Reference Location

The use of reference, or control, background areas represents a potential method of comparing impacted and non-impacted areas. Reference areas for appropriate aquatic ecosystems will be selected during the upcoming field event. The reference area or areas will generally be upgradient from the disposal mound or suspected test plot locations to avoid potential contamination. The number of reference areas chosen and their sizes will reflect the major characteristics of the sample stations. One reference area of each major ecosystem type will be chosen. The reference and test areas will be similar in topography, soils, water chemistry, and ecosystem present. Access to the reference station(s) will be limited to the sampling crew to limit sample disturbance. Presently, station OC-SW-01 is assumed to be the reference.

2.4 Sediment Sampling

As discussed in Section 2.3, surface water at the site is drained by several small tributaries flowing into Snowbank reek which inturn flows into the Ogotoruk Creek. There is also an ephemeral pond located adjacent to the disposal mound. For the sediment investigation task, the aquatic environments of concern will be the same as those in the surface water investigation: Snowbank Creek (SEC); Tributary No. 3 of Snowbank Creek (T3): Ogotoruk Creek (OC); and the unnamed ephemeral pond (EP).

Tentative sediment sample stations will be collocated on each of the waterbodies with surface water stations. These locations were selected based on the June, 1993 field reconnaissance. Station locations may then be refined during investigations based on the actual field conditions encountered, if stations are moved, the new location will be documented on the appropriate field forms. The selected stations will be flagged with pin flags and/or flagging tape. Sample locations will be determined and verified by GPS field survey (SOP-CHR-23). All locations will be recorded on maps generated from USGS topographic quadrangle maps. Sampling activities will be recorded with photographs (SOP-CHR-06).

During the sediment investigation, the physical characteristics of the creeks sections and pond will be documented in a bound field notebook, FADLs, and on field survey maps (SOP-CHR-01). Descriptive parameters such as creek width, pond size (where applicable), color, turbidity, flow rate, bank vegetation, emergent vegetation, available fish cover, and bottom substrate will be recorded on the field data sheets. Water quality parameters taken during the surface water investigation utilizing the Horiba water quality checker and current velocity recorded from the flowmeter will be noted.

Representative samples of the sediments water will be collected in accordance with SOP-CHR-07 and will achieve the project-specific DQOs listed in Section 1.6. Discrete grab samples will be collected and submitted for analysis both to the on-site and off-site laboratories. If required, split samples will be collected as described in SOP-CHR-30. The sample bottles will be labelled using an alpha-numeric code using the sample identification code provided with a sequential number added.

In conjunction with sediment sampling, a 250-milliliter (ml) sample will be collected for grain size analysis. This sample will be shipped to the IT Edison bioassay laboratory for analysis. the samples will be partitioned in three or more fractions, in addition to percent moisture of the sediment, depending on observed characteristics of the samples. Grain size analysis is a useful tool for assessing macroinvertebrate habitat (i.e., suitability of benthic substrate to sustain a quality habitat for benthic macroinvertebrates).

Field blank samples will be collected at a rate of one a day.

2.5 Procedures for Radiological Survey

Concurrent with the sediment and surface water sampling, a radiological survey will be conducted. The radiological survey will be performed to characterize the surface radiation fields along Snowbank Creek, Tributary No. 3 of Snowbank Creek and Ogotoruk Creek. Tundra on each side of the Snowbank Creek, beginning at the confluences of Snowbank Creek and Ogotoruk Creek to the point where the Snowbank tributaries meet, will be examined visually in an attempt to locate the original experimental test plots. The sampling effort will include in-situ radionuclide concentration measurement of all identifiable test plots and the disposal mound, on-site laboratory radionuclide concentration measurements of soil collected at different depths at these same locations, and surface radioactivity scans of the remaining region. In addition, all visibly disturbed areas in the region of the camp will be scanned for possible radionuclide contamination. Areas that can be identified as test plots will be marked with stakes and rope or by other appropriate means. The radiological survey will verify whether the level of soil radioactivity indicates that the original experimentally placed radioisotopes have been removed.

The type of radioisotopes used in the plots and their original activity, in 1962, are as follows:

Radioisotope	Total Activity (At time of Test)	Half-Life	Radiation
Cesium-137	2 x 10^8 becquerels (6 millicuries)	30 years	Beta, Gamma
Iodine-131	2 x 10^8 becquerels (5 millicuries)	8 days	Beta, Gamma
Strontium-85	2 x 10^8 becquerels (5 millicuries)	64 days	Beta, Gamma
Project Sedan Fallout	4 x 10^8 becquerels (10 millicuries)	Various	Alpha, Beta, Gamma

The activity of all of the above radioisotopes has decreased over the thirty years since the tests were conducted at the site. Only Cs-137 and some of the fallout isotopes (e.g., Am-241) are expected to have any detectable activity today.

To determine the surface activity at the site, appropriate radiation detection and measurement instruments have been chosen based on the type and energy of the radiation emitted from the radioisotopes of concern. Since alpha and beta radiation have a shorter range and can be easily attenuated by the soil, gamma detection instruments will be used. Two different types of instruments will be used: Pressure Ion Chamber (PIC) and NaI systems. The procedures for the use of these instruments and the performance of the radiation survey activities are provided in SOP-CHR-03, -11, -12, -13, -14, -15, -16, -17, and -18. The NaI system will be used for the majority of the survey activities. The PIC will be used at selected grid points and to obtain background data.

2.5.1 Instrumentation

A PIC will be used to measure the gamma-ray exposure rate in units of microroentgen per hour (μR/hr) at selected grid points. The PIC will be used to obtain background and correlation information. The PIC was selected for use at the Chariot Site because it is a complete, ultrasensitive, gamma-ray exposure monitoring system designed to measure and record low-level exposure rates, such as those due to natural background radiation. The PIC model that will be used is manufactured by Reuter Stokes, model number RSS-112. It is housed in two cable-connected weatherproof enclosures. The sensor housing contains a high-pressure spherical ionization chamber with direct mounting to a solid-state electrometer. The control housing contains read-out devices and control circuitry. The flux range of the PIC is 0 mR/hr to 100 mR/hr.

Two NaI detector systems will be used for the majority of the radiation survey activities. Both of the systems will use 7.5 by 7.5-cm (3 by 3-in.) NaI detectors shielded with approximately 2-cm (3/4-in.) lead to collimate the detectors' responses to an approximately 2-m (7-ft) diameter when held 1 m (3 ft) above the ground surface.

The first system is an NaI coupled to an Eberline Model ESP-2 ratemeter (referred to as ESP-2 system for remainder of text).

The ESP-2 system will be used to obtain background and correlation data, as well as to measure radioactivity levels from soil surfaces. The ESP-2 system was selected for use because it can operate in count-rate and integrate modes and a region-of-interest can be set to measure the pulse height corresponding to the gamma energy of a specific radionuclide.

If anomalies are detected with the ESP-2 system, weighted a flag will be dropped at that location and an in-situ NaI system will be used to obtain concentration data (SOP-CHR-15). Anomalies are identified as those areas that exceed the level at which there is 95 percent confidence that the measurement represents only background variations (95 percent lower limit of detection [LLD]). The second NaI system is a NaI coupled to a Canberra Multichannel Analyzer (MCA), which will be used to measure in-situ radionuclide concentrations in the soil (referred to as the in-situ NaI system for remainder of test).

This device can display and analyze a full energy gamma radiation spectrum allowing distinction between background and contaminant radionuclide. The particular MCA system is light weight and can be interfaced to the onsite laboratory system for further detailed analysis. The result of the analysis can be related to the soil concentration if the vertical distribution on the soil is known or can be assumed. The LLD is set in accordance with the steps provided in SOP-CHR-16.

A correlation of the NaI and PIC readings will be performed in accordance with SOP-CHR-17. Daily source and background checks of radiation survey instruments will be conducted in accordance with SOP-CHR-18.

2.5.2 Establishment of Grid and Visual Identification of Test Plots

Prior to performing the radiation survey, a grid pattern will be established and marked along the Snowbank Creek from the confluences of Snowbank Creek and Ogotoruk Creek to Tributary No. 3 of Snowbank Creek. The creeks are used as a point of reference to determine the test plot location.

The test plots from the Project Chariot: 1962 Tracer Study were along the Snowbank Creek not more than 21 m (70 ft) from the edge of the creek (personal interview, 1992). The grid will extend 21 m (70 ft) beyond the banks of the banks of the creek to the north and south as shown in Figure 2-1. Therefore, the grid system will be established in reference to a fixed site location and consist of mutually perpendicular lines spaced at equal intervals, dividing the survey location into blocks of equal area 21 by 30 m (70 by 100 ft), as shown in Figure 2-1. The intersections of these grid lines are referred to as grid nodes. The grid system will be established in reference to the confluence of Ogotoruk and Snowbank Creeks through the use of the GPS system and field surveying techniques. The contiguous collection of grid blocks along the Snowbank Creek will comprise the grid area that will be the functional unit used for making comparisons with established clean-up levels and to assess the adequacy of the remedial action of the plots.

While the grid is being marked, visual observations will be made to attempt to identify disturbed areas that may constitute the old test plots (refer to SOP-CHR-12). Potentially identified test plots will be approximately located within the grid using grid markers (such as distance from the creek or nearest two grid points) and documented on field forms. Flags or survey stakes with identifying numbers will be placed at the approximate center of the plot. These provisionally identified test plots will be compared to the historical documentation on the test plots in order to determine if the original test plot(s) has been identified.

2.5.3 Survey of Identified Test Plots

A scanning radiation survey will be performed in the test plot. The entire test plot will be surveyed by slowly scanning over the ground surface with the ESP-2 system. While scanning the ground, audible signals from the ESP-2 will indicate if a pre-set alarm level for Cs-137 has been reached. The pre-set alarm level for Cs-137 is the 95 percent LLD as described in SOP-CHR-16. A flag will be dropped to mark that area prior to completing the rest of the survey, and these areas will be marked on an appropriate field form.

CHARA12 07/02/93 12:00PM JRB

DRAWN BY	R. BATES	CHECKED BY	[signature]		DRAWING NUMBER	301971.201.07
	01/13/93	APPROVED BY	[signature]			

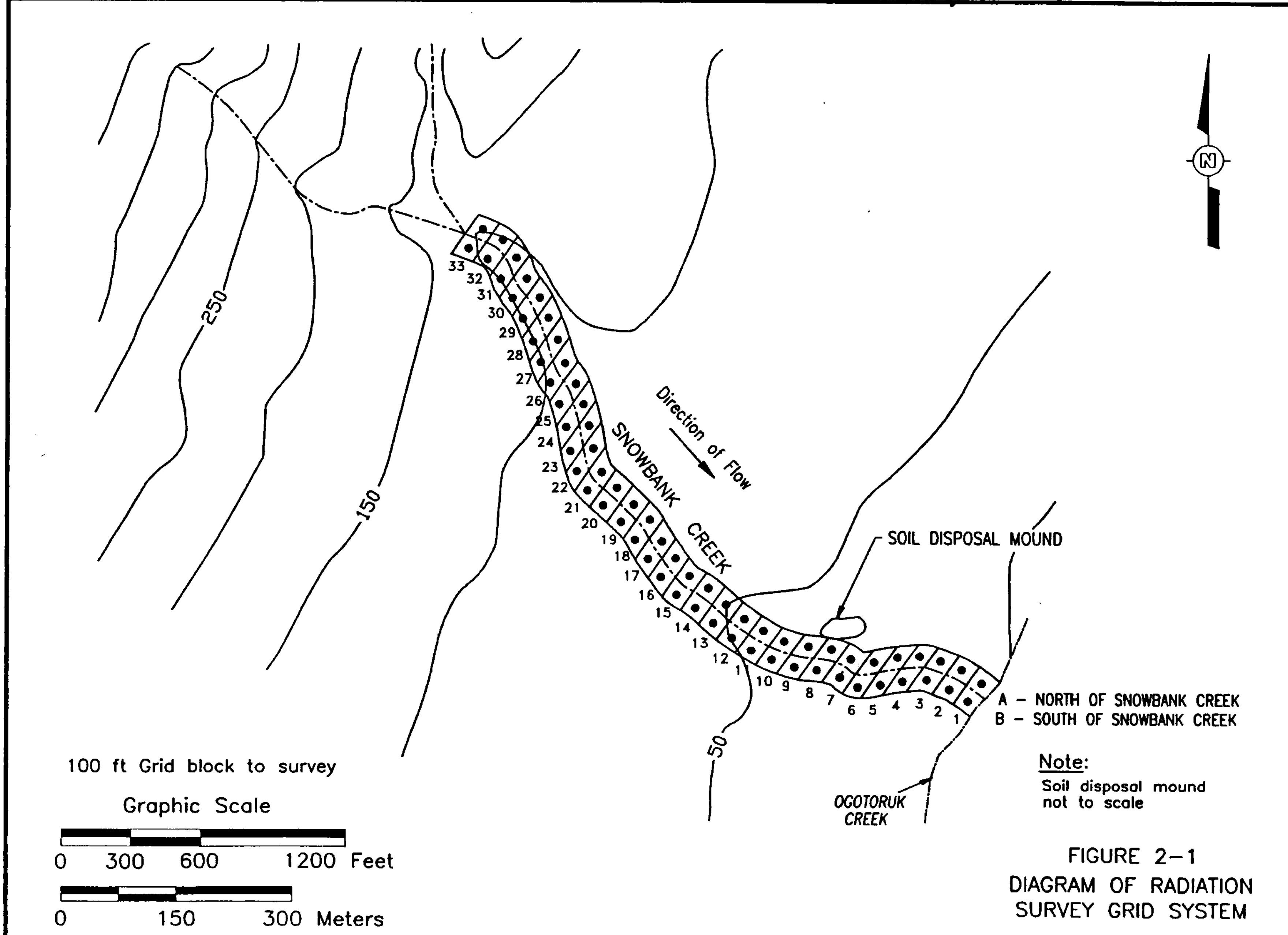


FIGURE 2–1
DIAGRAM OF RADIATION SURVEY GRID SYSTEM

The soil survey with the ESP-2 system will detect and identify locations of above-background radioactivity only and does not result in a quantitative measurement of radionuclides. Therefore, flagged areas from ESP-2 surveys will be further characterized by additional radiation survey measurements with the in-situ NaI system. Static measurements will be performed with this system to record radionuclide activities at different energy levels, specifically for Cs-137. The system will be set-up above the center of the flagged area. The in-situ NaI detector will be suspended 1 m (3 ft) above the plot using a tripod (refer to SOP-CHR-13 and -14). The suspect areas will be surveyed to determine if there is an elevated activity of radionuclides that exceed 95 percent of the LLD for Cs-137 and to determine the aerial extent of the contaminated area. The soil activity of Cs-137 will be evaluated against its background activity to determine if soil excavation is necessary.

2.5.4 Soil Sampling of Identified Test Plots

At each identified test plot, surface soil samples will be collected in accordance with SOP-CHR-10. Samples will be removed from each sample location by either a hand trowel or soil auger. Samples will be from 5 cm (2 in.) and 10 cm (4 in.) in depth and placed in a plastic container for laboratory analysis. Vertical migration profiles, will be determined from the analytical results of these soil samples for purposes of establishing the removal volume for cleanup if soil activity is greater than 0.4 Bq/g (10 pCi/g). If the on-site analytical results indicate elevated levels of radionuclides in the soil sample collected at a depth of 5-10 cm (2-4 in.), then additional 5-cm (2-in.) soil samples will be collected from the sample location (following the removal lift of soil) until the analytical results indicate levels equal to or less than background.

2.5.5 Radiation Survey of Site Area

After completion or in conjunction with the radiation survey and soil sampling of the test plots, the remainder of the grids (Figure 2-1) will be surveyed with the ESP-2 system. Procedure SOP-CHR-15 describes in detail the backpack system that will be used for this survey. This system is comprised of a backpack frame with a mounted bar from which two shielded NaI detectors are suspended. Two ESP-2 ratemeters will be attached to the technician's backpack belt (Figure 2-2). This system allows the technician to cover twice as much area since each detector will be shielded to observe a 2-m (~7-ft) diameter circular area. The technician will walk at a slow rate (approximately 1 meter per second (m/s) [3 feet

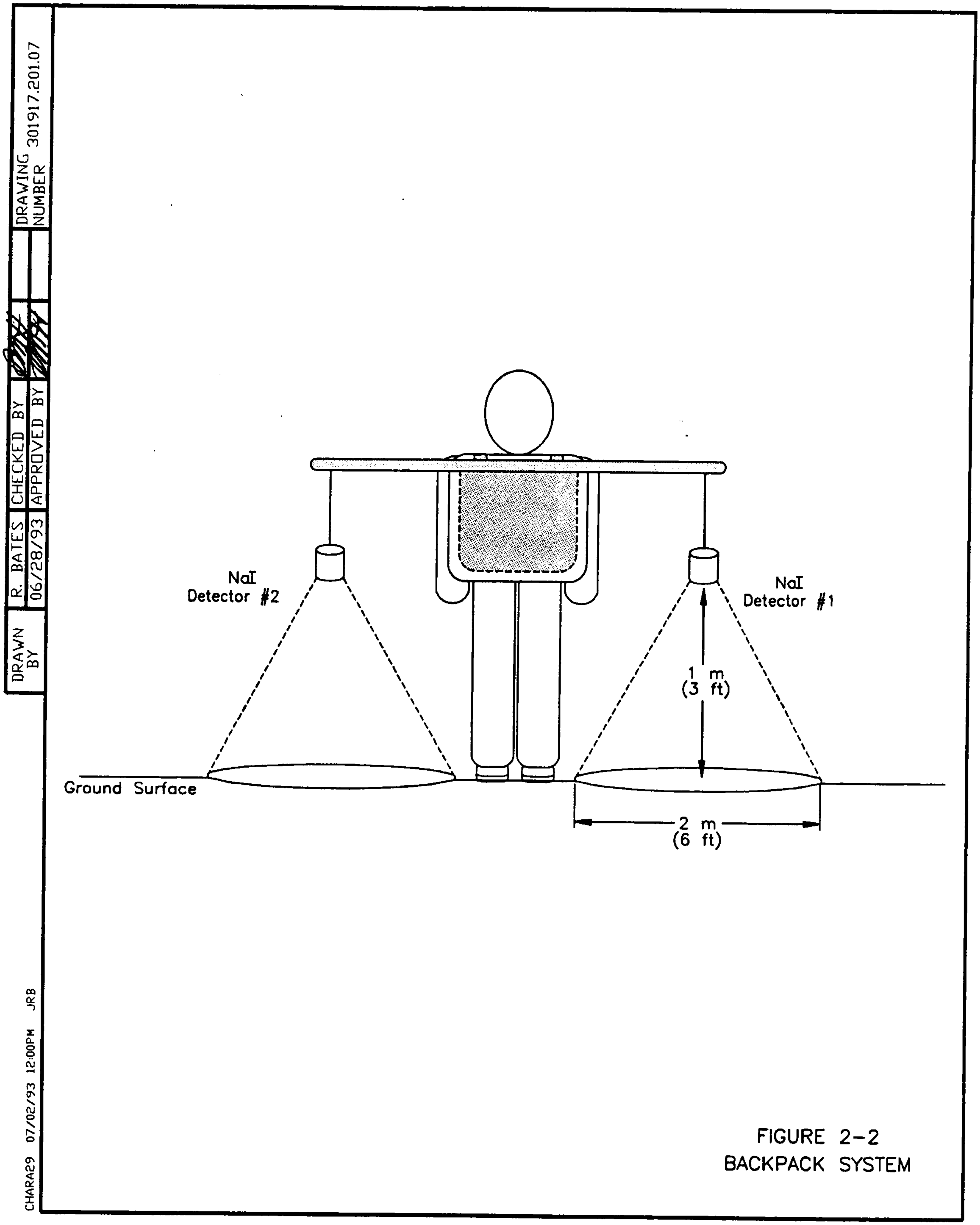


FIGURE 2-2
BACKPACK SYSTEM

per second (ft/s)]). Areas having increased levels of Cs-137 (greater than 95-percent LLD) will be flagged. These flagged areas will be documented on the appropriate field form and map and further monitored with the in-situ NaI system (refer to SOP-CHR-14 and 03). Surveys with the backpack system will continue until all grids are completed.

2.5.6 Radiation Survey of Disturbed Areas

Radiation surveys using the backpack system will be performed at disturbed area outside the gridded area shown in Figure 2-1. These areas may include the campsite, the landing strips, roadways, other areas connected by trail or track (i.e., motor vehicle tracks) to these disturbed areas, and disturbed areas documented by aerial photographs.

These disturbed areas are being investigated to confirm that no other radiologically elevated areas exist outside of what was reported in the Project Chariot: 1962 Tracer Study.

2.6 Interpretation of Measurements

Data will be evaluated using standard statistical procedures. The data will be analyzed to determine if the soil at any location is contaminated above the background concentration. Any contaminated region will be further analyzed to deterine the above background concentration and the lateral and vertical distribution in the soil. Background exposure rate and radionuclide activity will be determined with measurements collected near the Project Chariot: 1962 Tracer Study area in similar soil and terrain. SOP-CHR-14, -15, -16, and -17 provide information to be used in data interpretation. Mean and standard deviation will be determined for the background measurements. A measurement for radionuclide concentration above the 95-percent LLD will be used as an investigation/action level.

3.0 Excavation Site Surveying and Sampling

Following completion of the Project Chariot: 1962 Tracer Study, each test plot experiment and the percolation-test soil was removed and transported to the present site of the mound. Nine of the test plots were located in the immediate vicinity of the mound. According to historical documents, the excavated soil from these plots was mixed with local soils, resulting in a mound 0.46 m (1.5 ft) thick and 6 by 6 m (20 by 20 ft) in width. The boards and polyethylene sheeting used in the experiments were added to the contaminated soil, and the mound was covered with around 1.2 m (4 ft) of clean soil to form a mound about 2 m (6 ft) thick and 12 by 12 m (40 by 40 ft) in width. The average concentration of the radioactivity in the soil was estimated in 1962 to be approximately 9.6 Bq/g (0.26 nanocuries per gram [nCi/g]).

The mound will be sampled, and the soil will be removed and stockpiled as backfill, or containerized and disposed of as waste. This section addresses the surveying and sampling of the mound excavation site.

3.1 Sampling Objectives

Because this is an excavation and removal effort, three distinct sampling activities will be required to accomplish the following objectives:

- Collect representative soil samples from the excavated soil. The purpose of the samples is to expedite the waste characterization process for off-site disposal, to establish DOT shipping requirements, and to separate soil that can be used as clean backfill from soil that must be disposed of as waste.

- Collect shallow surface background samples from undisturbed locations in the Ogotoruk Valley. The resultant analytical data will be used for comparison against the established clean-up levels for this site.

- Verify that the excavation of the mound has been accomplished to the extent that the established clean-up levels have been reached.

Additional sampling and analysis will be required to meet off-site facility disposal criteria. In addition to sampling activities, a radiation survey will be conducted at the mound excavation site. The purpose of the radiation survey is to ensure that worker health and safety is protected, to locate anomalies that may require laboratory analysis for verification, and to assist with the waste characterization process.

As discussed in Section 1.6, DQOs are established for the project to ensure that the data collected are sufficient and of adequate quality for their intended use. Data quality factors considered in the development of DQOs include defined appropriate analytical levels, prioritized data uses, radiological isotopes of potential concern, chemicals of potential concern, and required detection limits. The DQOs for the sampling and analytical program are presented in Table 3-1. Levels I, II, and V analytical requirements will be employed for the radiological characterization sampling activities. Samples will be analyzed on site for gamma spectra. Samples will be submitted to an off-site laboratory for confirmatory analysis of gross alpha, gross beta, and gamma spectra. Waste characterization samples will also be

Table 3-1
Data Quality Objectives for Project Chariot for the Site Assessment and Remedial Action

Activity: Sample Type	Data Objective[a]	Analytical Quality Level	Analyses	Required Detection Limits
Remedial Action				
Soil Samples	1	Level II,[b] Level V	Rad[c]	QAPjP-required detection limits
Soil Samples from mound or test plots	2	Level I	Gamma Spec	QAPjP-required detection limits
	3	Level V, Level III	Rad[c] EPA[d]	QAPjP-required detection limits EPA-required detection limits
	4	Level II, Level V	Rad[c]	QAPjP-required detection limits

[a]Data Objectives are:
(1) Determine presence/absence of radioisotopes of concern (on-site lab analysis for gamma spectroscopy, off-site lab analysis for gross-alpha and gross-beta analysis and gamma spectroscopy
(2) Determine presence/absence of gamma emitting radioisotopes of concern (on-site screening)
(3) Characterize materials that are classified as waste.
(4) Establish background concentration of radioisotopes of concern.

[b]On-site lab
Off-site lab

[c]Rad - includes gross alpha, gross beta, and gamma spectroscopy

[d]EPA - Environmental Protection Agency Methods for PCBs and total organics, inorganics, and metals

analyzed at an off-site laboratory (Level III) for total organics, inorganics, and metals; PCBs; and free liquids. Sampling SOPs to be used are SOP-CHR-01, 02, 04, 06, 09, and 10. Additional SOPs that will be used for radiation screening and determining background levels are SOP-CHR-12, -13, -14, -15, -16, -17, -18, and -19.

Field activities will include a radiation survey and collection of background soil, shallow subsurface soil, and excavation soil samples for analysis. A reconnaissance visit on October 21, 1992, indicated only background levels of radiation. Areas will be documented by photographs prior to and following completion of field activities.

3.2 Radiation Survey of Mound

The mound will be removed in 0.3-m (1-ft) lifts using standard earth-moving techniques. Before removal of each lift, the surface of the mound will be scanned near-surface using the ESP-2 system to map any areas of radiological contamination above the 95-percent LLD. The procedure for determining the 95-percent LLD is presented in SOP-CHR-16; the procedure for using the ESP-2 system and interpreting the data from that system are found in SOP-CHR-15. All regions of the mound will then be analyzed at a minimum of 6 locations using an in-situ NaI system along a pre-established grid as discussed in SOP-CHR-19 and Section 3.4. The in-situ NaI system allows the user to determine concentrations of Cs-137. Cesium-137 is used as the tracer for contamination because it is the only radionuclide expected to be found in above fall-out background concentrations. In the event that a large concentration of the Sedan fallout-soil radionuclides are found, radionuclides other than Cs-137 (such as Sr-90, Co-60, Am-241, and Pu-239) would be found in comparable concentrations. Therefore, the in-situ system can also be used to confirm that contamination was from the Sedan fallout soil by further on-site laboratory analysis.

If no contamination is found, the soil will be removed from the mound in a 0.3-m (1-ft) lift and placed on HDPE, and the mound will be resurveyed with both the ESP-2 and in-situ systems as outlined above. If the mound survey finds no radioactivity above the 95-percent LLD after the lift is removed, the soil on the HDPE will be assumed to be clean and will be used to backfill the mound excavation. The soil on the HDPE will then be analyzed with the in-situ NaI system at four locations, and a soil sample will be collected for compositing at each of those four locations to verify that the soil is clean. The sampling process is described in detail in SOP-CHR-10 and in Section 3.4. If a measurement exceeds the 95-percent LLD on the mound after the lift is removed, the soil on the HDPE will be assumed to be contaminated, and the same four-point sampling procedure will be followed to quantify the level of contamination. If this additional surveying and sampling should find the soil to be clean, it will be returned to the mound location as backfill after excavation activities are completed. The excavated soil will be covered with HDPE to prevent soil particles from becoming airborne.

The radiation survey and screening process will continue with soil samples collected at 4 locations until clean soil is reached at the bottom of the mound. Clean closure sampling will be conducted as described in Section 3.4.

3.3 Background Sampling for the Mound

Surface background soil samples will be collected from undisturbed locations in the Ogotoruk Valley. One samples will be a field duplicate. Surface background samples will be collected east of the Ogotoruk Creek, upstream of the confluence of Snowbank Creek and Ogotoruk Creek. This general area was chosen to avoid the potentially impacted areas resulting from the Project Chariot: 1962 Tracer Study. An established benchmark will be used to reference sampling locations. Points within the grid will be randomly selected to designate unbiased sample locations. A duplicate sample will be taken at one of the sampling locations. Each sampling location will be accurately described using GPS and field surveying, and documented on a map generated from a USGS topographic quadrangle map. Selection of the criteria for defining an acceptable accuracy for background determination will be arbitrary, based on the natural variations (of background levels) occurring in the environment and the need to keep the effect and cost directed to background determination reasonable. The analytical results of these background samples will be compared to the established clean-up levels for this project. The sample collection procedures are presented in SOP-CHR-10. Procedures for selecting background sampling locations may be found in SOP-CHR-22.

3.4 Post-Excavation Sampling

Subsequent to the completion of all excavation/removal activities, a sampling effort will be implemented to verify that the excavation of the mound has been accomplished to the point that an established "clean-up" level has been reached and to assist with characterization of waste materials.

This sampling effort will be accomplished using a two-step process:

1. Radiation Survey of Mound Location
2. Soil Collection and Analysis.

The sampling locations at the soil disposal mound excavation will be determined using a hexagonal grid design (refer to SOP-CHR-19). The method for selecting sampling locations is in the *Field Manual for Grid Sampling of PCB Spill Sites to Verify Cleanup* (EPA, 1988) and is used as the best-engineering practice. Hexagonal grid sampling has the characteristic of being easy to implement under most field conditions. The grid design is essential to obtain a representative sample of the site and greatly increases the chance of detecting contamination when it exists. Choosing soil sampling locations using this method will fulfill the post-excavation sampling objective: to verify that the excavation of the mound has been accomplished to the point that acceptable "clean" levels have been reached. Sampling of all the points on the grid will result in a 98-percent confidence level that the soil of concern has been removed.

The rationale supporting the radiation survey effort is to identify any potential elevated areas prior to proceeding with the "clean" closure sampling effort. In order to expedite this program in a timely and cost effective manner, the survey effort will enable the sampling team to achieve a relatively high degree of confidence that the excavation has been accomplished to the extent that "clean" levels have been reached and thus should only require a one-time confirmatory "clean" closure sampling effort.

Grab samples will be collected from each sampling point that is located within the excavation boundaries and submitted for on-site field screening analysis. The procedure for collecting the sample by hand trowel or hand auger is presented in SOP-CHR-10.

At the completion of the radiation survey effort, if no sample locations exceeded the defined action levels, samples for closure purposes will be collected. The same grid system (i.e., sample locations) employed for the on-site field screening effort will be employed for this effort. However, the excavation site will be evenly divided into four quadrants (marked N, S, E, W in Figure 3-1). Grab samples will be collected from sample points per quadrant and then composited as one. Thus, one composite sample per quadrant will be submitted for

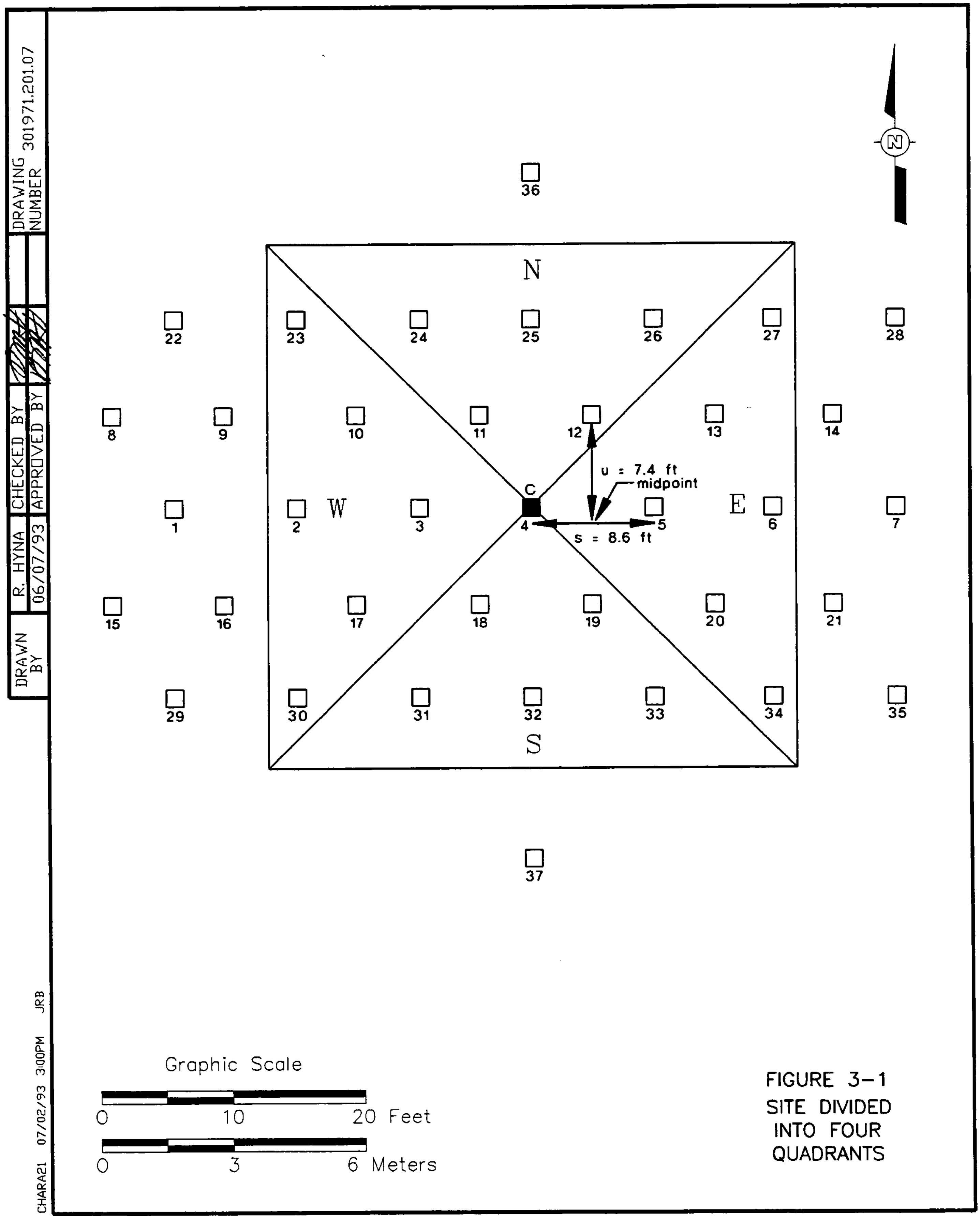


FIGURE 3-1
SITE DIVIDED
INTO FOUR
QUADRANTS

analysis. One duplicate will also be submitted for quality control. The procedure for collecting the samples is presented in SOP-CHR-10. The sampler will record all the required information regarding the sample and instructions to the lab regarding the disposition of the sample. Samples will be analyzed at the on-site laboratory for gamma spectra and will also be analyzed at the off-site laboratory. The off-site laboratory will additionally analyze for RCRA and other radioactive constituents.

3.5 Waste Characterization Samples

Contaminated soil (i.e., above 0.4 Bq/g [10 pCi/g] Cs-137) from the mound or from test plots will be sampled, analyzed, and managed as waste. Section 13.0 of the Remedial Action Plan discusses waste acceptance requirements for the potential disposal sites. Waste from the excavation will be surveyed with the in-situ NaI system and sampled for analysis in the on-site and off-site laboratories.

Current knowledge of the past project activities indicates that there is no reason to suspect that Resource Conservation and Recovery Act (RCRA) regulated constituents will be present in the waste. However, in order to satisfy the most stringent waste acceptance criteria, samples will be collected for RCRA analysis.

Due to the process used to create the mound (i.e., clean, native soil was placed on top of the contaminated soil), and knowledge of the Project Chariot: 1962 Tracer Study, it is assumed that any RCRA-regulated materials could only have been introduced during mound construction. The top two to three 0.3-m (1-ft) lifts are assumed to be uncontaminated and will be used as backfill after mound excavation. This will be confirmed through on-site screening for radiological constituents. The remaining soil will be removed and properly managed as waste. Before the soil is excavated from the mound, it will be surveyed for radiation and characterization samples will be collected. A hexagonal grid will be laid out on the mound for sampling purposes (see SOP-CHR-19).

Two grid blocks from each contaminated lift will be chosen at random for waste characterization sampling. Samples will be collected and analyzed for total organics, inorganics, metals, and PCB's. One sample from each lift will be collected and analyzed for free liquids.

Methods to be used are:

Organics	Gas chromatographic/Mass Spectroscopy: EPA Methods 8240 and 8270
Inorganics/Metals	Atomic Absorption Spectroscopy: AAS Methods listed in 40 C.F.R. 261, Appendix III, Table 3
	Inductively Coupled Plasma-Atomic Emission Spectroscopy
PCBs:	EPA Method 8080
Free Liquids:	EPA Method 9095, Paint Filter Liquids Test

These analyses will provide adequate data to determine if low-level waste acceptance criteria are met. If total organics, inorganics, or metals are greater than 20 times RCRA regulatory limits for classification as hazardous waste (per 40 C.F.R. 261), additional analyses, in accordance with the Toxicity Characteristic Leaching Procedure (TCLP), will be conducted to provide additional data. In order to meet the most stringent waste acceptance criteria, PCBs must be less than 50 parts per million (ppm) and free liquids less than 0.5 percent by volume of the external waste container. If it is found that the waste acceptance criteria are not met, through these analysis, the waste will be appropriately managed as mixed waste or treated to meet waste acceptance criteria.

It was determined that only four waste package samples would be required because the statistical method for sampling for RCRA constituents (as found in EPA-SW-846, *Test Methods for Solid Waste*) is the cube root of the number of waste packages to the next largest whole number. The cube root method is applicable because of two factors: waste homogeneity and knowledge of the process used to create the waste. It is expected that the number of waste packages will be approximately 60; the cube root to the next whole number is four.

Rather than sampling the waste when it is placed in the packages, however, the samples will be collected from the lifts prior to excavation from the mound. This will help ensure that a representative sample is collected and analyzed. Records will be maintained to ensure that each lift is traceable to waste packages (by waste package serial number). A minimum of four samples will be analyzed; at least one from each lift. It is assumed that at least four lifts will be classified as waste. If less than four lifts are excavated and more than 27 boxes are filled, additional samples will be randomly chosen from one or more lifts to ensure that at least four samples are analyzed. In addition, one duplicate sample will be randomly chosen from one of the lifts.

If test plots are excavated for disposal as waste, the test plot soil will be placed on HDPE, homogenized to ensure sample representativeness, and one sample collected for the analyses indicated above.

This page intentionally left blank

4.0 Biological Sampling

Biological sampling will be performed to evaluate radionuclide concentrations of selected biota in the vicinity of the Project Chariot Site. Objectives of the biological sampling program are to (1) obtain samples of selected biological materials in the Project Chariot environs, (2) measure radionuclide concentrations for Strontium-90 and Cesium-137 in those samples, (3) compare current results to past measurements to the extent possible, and (4) make an evaluation of the radioecological significance of the results.

Samples of important lichens, sedges, and shrub species will be obtained from several locations in the Ogotoruk Creek Valley that were previously studied. Additional sites will be sampled to evaluate the migration of radionuclides from the Tracer Study mound into soils and vegetation near Snowbank Creek and at control sites in Kisimilok Creek environs.

Herbivores of the Project Chariot environs to be sampled include small mammals (voles and lemmings), arctic ground squirrels, and caribou. The small mammals and squirrels are locally abundant and forage on plants, and are expected to reflect the local herbivore diet. Caribou are seasonally abundant, principally during fall and winter months, and are an important food resource for several native villages of the region. Representative samples of the lichen-caribou-man pathway for radionuclides will be obtained from animals harvested by hunters of Point Hope and Kivalina.

Fish may not be sufficiently abundant in Ogotoruk Creek to provide samples for radionuclide analysis. During the 1959-1961 period of study, very few (less than 3) arctic char were found in the entire length of the creek. Although Ogotoruk Creek contains suitable habitat for a few salmon from time to time, the freezing of the creek during winter and its lack of access to the ocean, except for very few times of the year, apparently precludes its use by anadromous fish. Attempts to obtain fish from Ogotoruk Creek will be made, but based on available information, the probability of collecting fish samples is small.

All sampling locations will be staked, flagged, and recorded on the topographic map to allow resampling by other personnel, if necessary.

The quality control (QC) aspects of the biological sampling activities, such as sampling precision, accuracy, representativeness, completeness, comparability, (PARCCs) sample custody, and analytical procedures are discussed in the QAPjP.

4.1 Vegetation

Vegetation sampling procedures are detailed in SOP-CHR-24.

4.1.1 Lichens

Lichen communities of the Project Chariot environs occur discontinuously over the landscape rather than in carpets such as occur on caribou winter ranges to the southeast. Four major types of lichen communities from six initial locations will be sampled (Figure P-3 in Attachment D of the RAP), as listed below, and in Table 4-1:

- *Cladina-Cetraria* -Location 2 (Upper Ogotoruk)
  -Locations 6 and 10 (Snowbank)
  -Location 3 (Pumaknak Pond)
- *Cornicularia spp.* -Location 4 (Upper Ogotoruk)

- *Cetraria delisei* -Locations 6 and 10 (Snowbank)
- *Masonhalea richardsonii* -Locations 6 and 10 (Snowbank) and mound.

4.1.2 Vascular Plants

Sedges are the most ubiquitous plant communities of the tundra and are easily sampled on an areal (square meter) basis that allows estimates of biomass and radionuclide inventory. The 1959-1961 studies found that the *Eriophorum* tussock community type covered 39 percent of the Ogotoruk Valley, *Dryas* fell-field covered 30 percent, and *Eriophorum-Carex* wet meadow covered 12 percent. Samples will be obtained of three major sedge community types at locations adjacent to the mound and at former study sites in the upper Ogotoruk Creek Valley.

Three samples will be collected from each location:

- *Carex* wet meadow -Locations 6 and 10 (Snowbank)
  -Location 7 (Ponds 4 and 6)
  -mound vicinity

Table 4-1
Proposed Vegetation Samples — Project Chariot Biological Sampling Task

Species	No. Samples at Locations — Ogotoruk Valley												
Species	#2	#3	#4	#5	#6	#7	#10	#12	#13	#16	GS	SR	Total
Lichens													
Cladina-Cetraria	3	3			3		3						12
Cornicularia			3										3
Cetraria delisei					3		3						6
Masonhalea rich.					3		3				3		9
												Subtotal	= 30
Vascular Plants													
Carex wet meadow (Sedge)					3	3	3				3		12
Eriophorum tussock (Sedge)						3	3				3		9
Eriophorum-Carex (Sedge)					3	3	3				3		12
Dryas integrifolia					3		3					6	12
												Subtotal	= 45
Shrubs													
Salix spp. (Willows)				3				6	3	3	3		18
Ericaceous					3		3				3		9
												Subtotal	= 27
												Total Samples	= 102

Mammals*

Sample Type	Locations	Total
Voles/lemmings	GS - USGS Mound	5-10
Voles/lemmings	#6 - Snowbank Creek	5-10
Voles/lemmings	#10 - Snowbank Creek	5-10
	Subtotal Composited Samples	15-30
Ground squirrel	#5 - Ogotoruk Creek mouth	8-10
Ground squirrel	#8 - Chariot camp site	8-10
Ground squirrel	#9, SR - General area (possibly other locations)	8-10
	Subtotal Individual Samples	24-30
Caribou (4-kg samples)	Point Hope	10
Caribou (4-kg samples)	Kivalina	10
	Total	20

GS = USGS Mound
SR = Saligvik Ridge
Note: It is estimated that about 40 samples will be collected in Kisimilok Valley (Control), for a grand total of about 142 vegetation samples. Two small mammal samplings sites are to be selected in Kisimilok Valley, from which we will attempt to obtain ~10 samples.
*All mammal sample quantities and locations are subject to change as required depending on population levels, occurrences, and habitat.

- *Eriophorum* tussock — -Location 10 (Snowbank Creek)
  -mound vicinity
  -Location 7 (Ponds 4 and 6)

- *Eriophorum-Carex* wet meadow — -Locations 6, 7, 10, and mound.

Carex aquatilis, the common sedge of wet meadows, will be the principal species collected. It grows in vast swards and can be easily collected in multiples of 1-m^2 (~11 ft^2) yielding biomass and radionuclide inventories of the community.

Eriophorum vaginatum tussocks will be sampled individually, and combined to provide sufficient biomass for radionuclide measurement.

Eriophorum angustifolium, E. russeolum, and *E. scheuchzeri* occur with *Carex aquatilis* in the *Eriophorum-Carex* wet meadow community type at Chariot. These three *Eriophorum* species are difficult to readily separate if not in flower. This community type is common near the mound, hence its importance.

Samples of the *Dryas* fell-field community will be obtained at the following locations:

- Location 6 (Snowbank Creek)
- Location 10 (Snowbank Creek)
- Saligvik Ridge exposed slopes about 5 to 6 km (3 to 4 mi) north of Locations 6 and 10.

The *Dryas* fell-field community type is often discontinuously distributed on exposed, windswept upland areas bordering the Ogotoruk Valley and dry, low ridges and bedrock exposures within the valley proper.

4.1.3 Shrubs

Willows of several species are the dominant shrubs of interest in the current studies. Current annual growth of feltleaf and other species of willow will be collected. Willows of several species will be sampled at the tracer mound and from the bench and bar communities along Ogotoruk and Snowbank Creeks by clipping terminal growth, which should contain mobilized radionuclides if they are present.

Samples will be collected at each location from the following locations:

- *Salix* terminal growth
  - Location 12 (Lower Ogotoruk)
  - Mound vicinity
  - Between Snowbank Creek confluence and mouth of Ogotoruk Creek
  - Ogotoruk Creek bar and bank communities upstream of Snowbank Creek confluence

Ericaceous shrubs, such as Laborador tea (*Ledum decumbens*), four-angled cassiope (*Cassiope tetragona*), and several others are found in snow accumulation areas. These will be collected on an areal basis so far as possible. Samples will be collected from the following locations:

- Adjacent to Snowbank Creek near Location 6
- Adjacent to Snowbank Creek near Location 10
- Adjacent to Snowbank Creek near the USGS mound.

Refer to Table 4-1 for a summary of estimated numbers of samples to be collected.

4.2 Mammals

4.2.1 Small Mammals

The collection of mammal samples will be authorized by an Alaska Department of Fish and Game (ADFG) Collector's Permit. Small mammals (voles and lemmings) will be collected by Museum Special snap traps set randomly at locations of animal signs such as runways and feeding sites. No attempt will be made to estimate populations, as the objective of the study is to collect animals for radionuclide analysis. Traps will be baited with peanut butter and rolled oats, set, and checked twice daily to remove animals in fresh condition. Weights and measurements will be recorded only if required by ADFG regulations. Specimens will be kept cool until returned to the field camp, where field data (weights, measurements, and identification) will be entered on Chain-of-Custody/Request for Analysis forms. Fresh specimens will be skinned, digestive tract and contents removed and discarded, and the carcass composited with other specimens of the same species and location. The samples will then be frozen in sample containers and shipped to the analytical laboratory for further processing and radionuclide analysis. The method is further detailed in SOP-CHR-20, Small

Mammal Sampling. Species expected to be trapped include the tundra vole (*Microtus oeconomus*), Alaska vole (*Microtus miurus*), Red-backed vole (*Clethrionomys rutilus*), Brown lemming (*Lemmus trimucronatus*), and Varying lemming (*Dicrostonyx sibericus*). Refer to Table 4-1 for numbers of small mammals to be collected.

Ground squirrels (*Citellus parryi*) will be live-trapped in Havahart-type traps, dispatched with a .22-caliber pistol, placed in individual labeled plastic bags, and kept in a cool container for return to the field camp. They will be processed in the same manner as the smaller mammals. Each ground squirrel will represent a single sample. Refer to Table 4-1 for numbers of samples to be collected. Species other than *C. Parryi* trapped in the Havahart traps will be released unharmed.

4.2.2 Caribou

Muscle and bone samples of caribou (*Rangifer arcticus*) will be obtained from native hunters in the villages of Point Hope and Kivalina. The Cape Thompson area is within Alaska Game Management Unit No. 23, administered from the ADFG office in Kotzebue. Appropriate personnel will be contacted regarding the project and required authorization will be obtained to take the above samples. The proposed purchase of caribou samples has been satisfied by the ADFG Scientific Collection Permit. Twenty 4-kg (9-lb) samples of animal haunches will be separated into muscle and bone, individually labeled, and kept frozen until shipment to the analytical laboratory. Results of these analyses will be used only with the knowledge that Chain-of-Custody requirements cannot be rigorously met and that, due to migration, the animals may have become contaminated from other sources.

4.2.3 Marine Mammals

Samples of marine mammals will be limited in number but collected in a manner similar to caribou. About 2 to 4 kg (4 to 9 lb) of muscle or whale blubber will be collected from each animal, labelled, and frozen until shipment to the analytical laboratory. Approximately 20 marine mammal samples will be obtained in cooperation with the North Slope Borough Wildlife Management Department to satisfy North Slope Borough residents' concerns about radioactive contamination of marine ecosystems. It should be noted that radiation detected in these samples may not be tied to the Project Chariot Site.

4.3 Kisimilok Valley (Control Area)

Limited sampling of biota will be conducted at three locations in Kisimilok Valley, concentrating on vegetation (lichens, sedges, *Dryas*, and willows) and small mammals. Replicate samples will be obtained of each sample type, resulting in about 50 additional samples.

Table 4-1 summarizes types and estimated number of samples to be collected in this task.

4.4 Birds

Authority has been obtained to allow the collection of 10 ptarmigan as part of biota sampling in Ogotoruk and Kisimilok Valleys in response to requests of North Slope Borough and residents.

The sampling method is detailed in SOP-CHR-21, Ptarmigan Sampling. This data should be considered only as level 1 screening on the basis that these numbers may not be statistically significant, and ptarmigan may migrate and become contaminated from other sources.

4.5 Fish

As previously stated, fish may not be present in sufficient numbers in Ogotoruk Creek to provide samples for radionuclide analysis. However, attempts may be made to collect fish at five locations which will be determined during the July site assessment SOP-CHR-25. A 20 by 4-ft haul seine (0.25-in. mesh) will be used to make a minimum of three sweeps at each station. In addition, wire mesh minnow traps will be anchored at each station and will be checked and emptied once every 24 hours at minimum. The number of fish collected for analysis will depend upon the size of the fish present.

Specimens will be kept cool until returned to the field camp where weights, measurements, and species will be determined and entered on field logs and Chain-of-Custody/Request for Analysis Forms. Fish samples will be frozen and shipped to the analytical laboratory for processing and radionuclide analysis.

5.0 Interim Control of Investigation-Derived Wastes

Field investigation activities will result in the generation of potentially contaminated materials, known as investigation-derived wastes (IDW). The IDW must be managed in a manner that is protective of human health and the environment (EPA, 1991).

The types of IDW that may be generated at this site are:

- Personal protective equipment (PPE), which may include coveralls, gloves, and booties
- Disposable equipment (DE), such as broken or unused sample containers, sample container boxes, tape, trowels, plastic tube liners, spatulas, spoons, bowls, and ground and equipment covers
- Soil derived from test plots or the mound that is found to be above established "clean" levels
- Decontamination wastes, such as liquids used to wash equipment, cloth and paper wipe rags, and plastic bags.

Controls will be instituted to ensure that contaminated soil is not commingled with non-contaminated soil. Excavated soil will be placed on HDPE and covered with HDPE. All contaminated soil will be placed in standard Department of Transportation (DOT)-approved waste packages. Filling of the waste packages will be controlled in accordance with procedures developed under the applicable waste acceptance criteria (see Section 13.0 of the RAP).

All solid (nonliquid) PPE, DE, and decontamination wastes will be surveyed for radioactive contamination. If the survey measurements indicate that the materials are not radioactively contaminated, they will be placed in a secure container and will be removed from the site for ultimate disposition at an off-site location (to be determined prior to initiating on-site field operations). If the survey indicates that the radioactivity levels exceed regulatory release limits, the waste will be placed in the boxes along with the soil that is being managed as contaminated waste. Liquid decontamination wastes will be absorbed so that no free liquids are present. The absorbent material will be placed in the packages along with the soil.

This page intentionally left blank

6.0 Sample Handling and Preservation

Samples collected from the Chariot Site will be analyzed for radiological constituents at an on-site laboratory and an off-site laboratory. Proper sample handling required the selection of appropriate sample containers, preservation procedures, and holding times for the specific analyses. The required sample preservatives, container types, sample volumes, and holding times for analyses of the soil samples collected from the Chariot Site are given in Table 6-1.

Appropriate sample containers will be obtained from the IT St. Louis laboratory in accordance with Table 6-1. The containers will remain sealed until ready for use. After samples have been collected, the sampler will seal the containers (custody seal) and record all required information on the sample labels and sample collection log. This includes, but is not limited to:

- Sample number
- Sample location
- Sample depth
- Date and time collection
- Name of sampler.

The samples will be placed into a sample shipping container as described in SOP-CHR-01 and taken to a designated sample preparation area (if necessary) for proper labeling and shipping. Chain-of-Custody/Request for Analysis forms will be properly completed and will accompany the samples to the laboratory. Additional detail on sample shipping and packaging is provided in SOP-CHR-09.

Each sample container will be surveyed for the presence of external radiation to identify any special precautions necessary for the field personnel and to verify that the samples are shipped in compliance with DOT regulations and requirements and the International Air Transport Association (IATA) requirements. The sample containers will be placed in Ziploc® bags to minimize the potential spread of radioactive contamination to other containers during shipment. Radiation measurements will be taken to determine the radiation levels on contact and at 1 m (3 ft) from the shipping package. The data will be summarized on the shipping forms provided by the transportation company. The shipping label will include the proper

Table 6-1
Sample Container, Preservation and Holding Requirements for Soil, Water, and Sediments

Parameter	Media	Container Type	Preservation	Maximum Holding Time
Gross Alpha	Soil	1,000-mL glass or polyethylene, widemouth	None Required	6 Months
Gross Beta	Soil	1,000-mL glass or polyethylene, widemouth	None Required	6 Months
Gross Spec	Soil	1,000-mL glass or polyethylene, widemouth	None Required	6 Months
Gross Alpha	Water	1,000-mL glass or polyethylene, widemouth	2 mL 16 M HNO_3	6 Months
Gross Beta	Water	1,000-mL glass or polyethylene, widemouth	2 mL 16 M HNO_3	6 Months
Gamma Spec	Water	1,000-mL glass or polyethylene, widemouth	2 mL 16 M HNO_3	6 Months
Gross Alpha	Sediment	1,000-mL glass or polyethylene, widemouth	None Required	6 Months
Gross Beta	Sediment	1,000-mL glass or polyethylene, widemouth	None Required	6 Months
Gamma Spec	Sediment	1,000-mL glass or polyethylene, widemouth	None Required	6 Months
Volatile Organics	Soil	2 x 120-mL glass	Cool ~4°C (40°F)	14 Days
Semi-Volatile Organics	Soil	250-mL WM-Amber glass	Cool ~4°C (40°F)	14 days to ext.; 40 days ext. to analysis
PCBs	Soil	250-mL WM-Amber glass	Cool ~4°C (40°F)	14 days to ext.; 40 days ext. to analysis
Metals	Soil	250-mL WM-Amber glass	Cool ~4°C (40°F)	180 days (28 days for Mercury)

WM - Wide Mouth
Note: Organic Samples require matrix spike (MS) and matrix spike duplicate (MSD) sample per sample delivery group (SDG), per twenty (20) samples per fourteen (14) day period per matrix.

shipping name, an estimate of the activity for the major radioactive isotopes, and the number of containers.

6.1 Sample Custody

Sample custody ensures the integrity of the samples. Sample documentation provides valuable information in recording the sequence of events for individual samples. Chain-of-Custody/Request for Analysis (COC/RFA) forms effectively communicate to the laboratory the requirements for the submitted samples. Chain-of-Custody procedures are discussed in Section 5.0 of the QAPjP.

6.2 Sample Documentation

Documentation of field sample collection activities must be summarized on a daily basis on field sampling collection logs. The information to be included in these forms and in other field documents are addressed in SOP-CHR-01.

All documentation shall be completed with black, waterproof, smudgeproof ink. Mistakes shall be corrected by passing one line through the mistake, initialing and dating beside the line, and entering the correct information.

Chain-of-Custody procedures, sample labels, and custody seals are discussed in Section 5.0, Sample Custody, of the QAPjP.

This page intentionally left blank

7.0 Sample Analysis

Soil samples will be analyzed for the presence of radioactive materials. Table 3-1 in the QAPjP provides analytical procedures that will be performed with the associated detection limits. The detection limits specified are standard analysis parameters provided that at least 600 g (1.3 lb) of soil and 1,000 mℓ of water is provided for each sample. Lower limits can be achieved by the laboratory by concentrating a larger sample aliquot and/or counting the sample for a longer period of time.

Note: the volume weight of stone-free soil in the study ranges from 0.3 to 1.3 grams per cubic centimeter (g/cm^3) (0.2 to 0.8 ounces per cubic inch [$oz/in.^3$]).

No preservatives are required for the soil, however, sample containers used for water samples will have preservative added by the laboratory. If needed, 2 mℓ of 16 M HNO_3 preservative will be added to the water samples. Soil samples will be collected and placed in the containers, submitting at a minimum 100 g (0.2 lb) (dry weight) to the laboratory. No samples will be spiked in the field to serve as quality control samples. The laboratory will analyze at least one duplicate sample for each analyte listed in the Table 3-1 in the QAPjP. Samples shipped to the off-site laboratory from the field location will be shipped using an express transport service, equivalent to Federal Express. Aliquots will be removed by the laboratory to perform the associated analysis. The remaining sample material will be archived by the laboratory for six months in the event additional analyses are required. A Certificate of Analysis will summarize the results and be reported to the Project Manager within 45 days after the samples are received by the laboratory. A summary report of the post-excavation sample analysis results will be faxed to the site within 72 hours of the lab receiving the samples.

Waste characterization samples will be collected and analyzed in accordance with the EPA methods specified for the evaluation of Resource Conversation and Recovery Act (RCRA) levels for organics, inorganics, PCBs and metals.

Tables 7-1 through 7-4 in the QAPjP show the analytes of concern, the regulatory level (RLs), and the method detection limits (MDLs) or practical quantitation levels (PQLs) for these methods. The samples will be analyzed for free liquid by EPA Method 9095. If free liquid is present then the samples will be analyzed for polychlorinated biphenyls (PCBs) by EPA Method 8080.

8.0 References

IT Corporation, 1992, Personal Interview, Las Vegas, Nevada.

U.S. Department of Energy, 1992, *Draft-Environmental Implementation Guide for Radiological Survey Procedures*.

U.S. Environmental Protection Agency, 1986, *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods,* SW-846, 3rd ed., Washington, DC.

U.S. Environmental Protection Agency, 1987, *Data Quality Objectives for Remedial Response Activities,* EPA/540/6-87/003, Office of Emergency and Remedial Response and Office of Waste Programs Enforcement, Washington, DC.

U.S. Environmental Protection Agency, 1988, *Field Manual for Grid Sampling of PCB Spill Sites to Verify Cleanup,* Washington, DC.

Wilimovsky, N. J. and J. N. Wolfe, Editors, 1966, *Environment of the Cape Thompson Region, Alaska,* Office of Scientific and Technical Information, Oak Ridge, Tennessee, 1250 pp.

This page intentionally left blank

SAMPLING AND ANALYSIS PLAN

PART II

QUALITY ASSURANCE PROJECT PLAN

Project No. 301971
July 1993

Quality Assurance Project Plan
Project Chariot: 1962 Tracer Study
Site Assessment and Remedial Action

Prepared for:

United States Department of Energy
Nevada Operations Office
Las Vegas, Nevada

This page intentionally left blank

Quality Assurance Project Plan
Project Chariot: 1962 Tracer Study
Site Assessment and Remedial Action Plan

This page intentionally left blank

Table of Contents

Table of Contents *(Continued)*

Table of Contents *(Continued)*

List of Tables

List of Figures

List of Acronyms

Acronym	Definition
ADEC	Alaska Department of Environmental Conservation
AEC	United States Atomic Energy Commission
AIP	Agreement in Principal
ASTM	American Society for Testing and Materials
BFB	Bromofluorobenzene
COC	Chain-of-Custody
DOE	U.S. Department of Energy
DOE/NV	DOE Nevada Operations Office
DOT	U.S. Department of Transportation
EDT	electronic data transfer
EPA	U.S. Environmental Protection Agency
ERD	Environmental Restoration Division
ERP	Environmental Restoration Program
FADL	Field Activity Daily Log
FSP	Field Sampling Plan
GC	Gas Chromatograph
GRRASP	General Radiochemistry and Routine Analytical Services Protocol
HSO	Health and Safety Officer
IATA	International Air Transport Association
IT	IT Corporation
ITAS	IT Analytical Services
LCS	Laboratory Control Sample
MDL	Method Detection Limits
MS	Mass Spectrometer
NA	Not applicable
NCR	Nonconformance Report
NIST	National Institute for Standard and Technology
NTS	Nevada Test Site
PARCC	precision, accuracy, representativeness, completeness, comparability
PQL	Practical Quantitation Limits
%R	Percent recovery

List of Acronyms (Continued)

QA	Quality Assurance
QAMS	U.S. EPA Quality Assurance Management Staff
QAO	Quality Assurance Officer
QAPjP	Quality Assurance Project Plan
QC	Quality Control
RAP	Remedial Action Plan
RFA	Request for Analysis
RL	Regulatory levels
RPD	Relative Percent Difference
SAP	Sampling and Analysis Plan
SAS	Sampling and Analysis Supervisor
SOP	Standard Operating Procedure
SSHASP	Site-specific Health and Safety Plan
TCMX	tetrachlorometaxylene

This page intentionally left blank

1.0 Project Description

This Quality Assurance Project Plan (QAPjP) describes the measures that will be taken to ensure the quality of the sampling and analysis, radiological surveys, and waste handling and shipping for the Project Chariot: 1962 Tracer Study site assessment and remedial action. The information presented here supplements the Remedial Action Plan (RAP), Field Sampling Plan (FSP), and Site-specific Health and Safety Plan (SSHASP). This plan covers all of these activities except as noted and applies to activities affecting quality.

This QAPjP has been prepared based on guidance from the Environmental Protection Agency (EPA) Interim Guidelines and Specifications for Preparing QAPjPs (QAMS 005/80). This document provides the specific controls that are to be instituted to see that all activities are conducted in accordance with all applicable federal and state requirements and to assure that work meets all professional standards.

1.1 Project Chariot: 1962 Tracer Study Description

Project Chariot: 1962 Tracer Study was an experimental part of the United States Atomic Energy Commission's (AEC) Plowshare Program to use nuclear explosives for peaceful purposes. In 1958, the commission authorized planning and studies for an experimental harbor excavation in Alaska using radioactive material. The primary purpose of this project was to investigate the technical problems associated with the development of nuclear-excavation technology. At the same time, other studies were underway using nuclear explosives, including a test called Sedan, a cratering experiment carried out at the Nevada Test Site (NTS).

During the course of these environmental studies, the U.S. Geological Survey, under a license granted by the U.S. Atomic Energy Commission's (AEC's) Division of Licensing and Regulation, carried out a radioactive tracer experiment on the soils at the Project Chariot Site. Small quantities of radioactive material, including some soil containing radioactive fallout from the Sedan cratering experiment in Nevada, were used in site experiments and subsequently disposed by creating a mound of experimental materials that were covered by native soil. The following types and quantities of radioisotopes were used:

Radioisotope	Quantity	
	becquerels	millicuries
Cesium-137	2×10^8	6
Iodine-131	2×10^8	5
Strontium-85	2×10^8	5
Project Sedan fallout	4×10^8	10

1.2 Current Planned Activities

The remedial action will remove soil and other Project Chariot: 1962 Tracer Study materials from the disposal mound created at the completion of the study. Soil sample collection will be performed following excavation of the mound area to verify the site meets the established clean-up level of 0.4 becquerels per gram (Bq/g) (10 picocuries per gram [pCi/g]).

Radiological surveys will include aerial surveys and ground-based surveys. Aerial surveys will be made of the Ogotoruk Valley and an area of Kisimilok Creek for determining background radiation levels, and shall be conducted in accordance with established EG&G procedures. Walk-over surveys will be conducted of the mound surface, the surrounding area, the test plot areas where the tracer experiments were conducted, and along the creek banks.

Surface water and sediment samples from Snowbank and Ogotoruk Creeks will be collected to determine if any radioactivity above background is present.

Biological sampling will be performed of the biota of the local environs to measure the radionuclides present. Samples will be collected of both flora and fauna. This will include lichens, vascular plants, shrubs, herbivorous mammals, and fish, if available.

Upon completion of site assessment and remedial action activities, revegetation and stabilization of the site will be accomplished.

All sampling activities and ground-based surveys shall be performed in accordance with approved procedures by IT Corporation.

2.0 Project Organization and Responsibilities

The organization chart for the Project Chariot: 1962 Tracer Study site assessment and remedial action is shown in Figure 2-1. Organizations and positions responsible for project quality are discussed in the following sections.

2.1 U.S. Department of Energy/Headquarters Project Director

The U.S. Department of Energy/Headquarters (DOE/HQ) Project Director, or designated alternate, is responsible for project oversight, ensuring that all activities are performed in accordance with the Alaska Department of Environmental Conservation (ADEC)-approved Site Assessment and Remedial Action Plan and DOE Orders. The DOE/HQ Project Director has final authority and responsibility for the quality of the Project Chariot: 1962 Tracer Study site assessment and remedial action activities. This responsibility has been assigned to

Mr. Thomas M. Gerusky
U.S. Department of Energy
Division of Southwestern Area Programs (EM-452)
Office of Environmental Restoration
Washington D.C. 20585

2.2 U.S. Department of Energy, Nevada Operations Office Project Manager

The U.S. Department of Energy, Nevada Operations Office (DOE/NV) Project Manager, or designated alternate, will serve as the primary point of contact for all activities conducted under the Site Assessment and Remedial Action Plan. The DOE/NV Project Manager is responsible for ensuring that activities conducted during the remedial action at the Project Chariot Site fulfill the obligations of DOE/NV, as described in the Agreement in Principle (AIP) and the approved Site Assessment and Remedial Action Plan, and are of the expected quality. The DOE/NV Project Manager is responsible for technical oversight and project coordination between DOE contractors and other agencies. This responsibility has been assigned to

Mr. Kevin J. Cabble
U.S. Department of Energy
Nevada Operations Office
Environmental Restoration Division
Post Office Box 98518
Las Vegas, Nevada 89193-8518

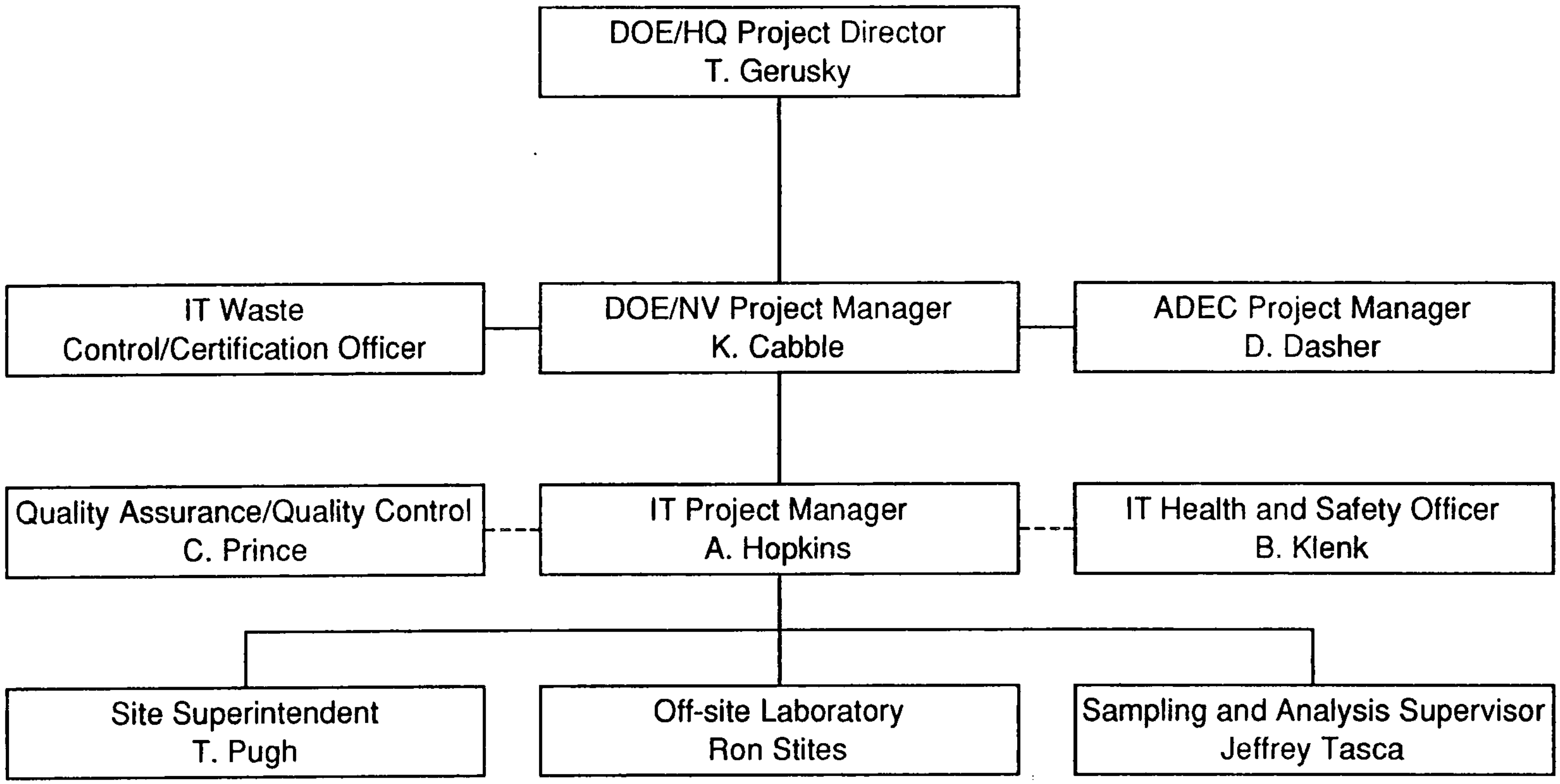


Figure 2-1

Project Chariot: 1962 Tracer Study Site Assessment and Remedial Action Organization Chart

Any variances/changes to project plans and procedures must be approved by the DOE/NV Project Manager prior to implementation.

2.3 Alaska Department of Environmental Conservation Project Manager

The ADEC Project Manager, or designated alternate, is responsible for ensuring that the State's responsibilities, as defined by the AIP, are fulfilled. The ADEC Project Manager, or designated ADEC representative, is responsible for oversight activities and monitoring the remedial action to ensure compliance with the ADEC-approved Site Assessment and Remedial Action Plan. This responsibility has been assigned by the ADEC to

Mr. Douglas Dasher
Alaska Department of Environmental Conservation
Northern Regional Office
1001 Noble Street, Suite 350
Fairbanks, Alaska 99701-4980

The ADEC Project Manager, or designated ADEC representative, will have the authority to evaluate postexcavation sampling analysis data and approve the final closure of the mound area.

2.4 IT Corporation Project Manager

The IT Corporation (IT) Project Manager will be the key technical operations manager for the remedial action project and will have primary responsibility for project plan development and on-site management of the remedial action implementation. The remedial action project will be managed in accordance with DOE Requirements and Orders and the IT Program Management Plan. The IT Project Manager is

Ms. Andrea Hopkins, CHMM, CEM
IT Corporation
4330 South Valley View, Suite 114
Las Vegas, Nevada 89103-4047

The IT Project Manager's responsibilities include

- Review of and compliance with all project-specific plans and procedures
- Assign duties to the project staff and assure orientation of the staff to the needs and requirements of the project

- Coordinate technical staff and other internal groups, such as Quality Assurance (QA), Health and Safety, and laboratories

- Implement the QAPjP through project staff.

2.5 IT Project Management Organization and Responsibilities

The IT organization for this project is a matrix structure, with central project authority vested in the IT Project Manager.

2.5.1 IT Program Manager

The IT Program Manager is responsible for the overall compliance and management of IT's contract in accordance with DOE Orders, policies, and procedures. The Program Manager has been delegated corporate authority to ensure that the project is adequately staffed with the required technical personnel. This responsibility has been assigned to

Dr. Joseph G. Yeasted, Ph.D., P.E.
IT Corporation
4330 South Valley View Blvd., Suite 114
Las Vegas, Nevada 89103-4047

2.5.2 Quality Assurance Officer

The Quality Assurance Officer (QAO) is responsible for coordinating the preparation of the QAPjP and the incorporation of applicable quality requirements. The QAO has the authority and responsibility to stop work when significant conditions adverse to quality are identified that cannot be expeditiously corrected. The Quality Assurance Officer is

Ms. Cheryl D. Prince, CQA
IT Corporation
4330 South Valley View Blvd., Suite 114
Las Vegas, Nevada 89103-4047

The QAO has oversight responsibilities for the project quality control activities. Specific responsibilities include

- Developing and implementing this QAPjP
- Serving as IT's organizational contact for all QA matters
- Preparing and submitting all QA reports to the appropriate line managers
- Verifying that appropriate corrective actions are taken on all QA issues
- Conducting surveillances of field activities
- Verifying that data of known quality and integrity are generated by project activities.

2.5.3 IT Project Health and Safety Officer

The IT Health and Safety Officer (HSO) has corporate oversight responsibilities for the project health and safety program. The HSO is

Mr. Brian G. Klenk, CIH
IT Corporation
4330 South Valley View Blvd., Suite 114
Las Vegas, Nevada 89103-4047

The HSO is responsible to the IT Project Manager for

- Developing and implementing the project Health and Safety Plan
- Ensuring the health and safety of workers and the general public during project operations
- Conducting surveillances and/or audits of field activities
- Implementing personnel monitoring
- Establishing personnel training requirements
- Reporting project health and safety concerns to the IT Project Manager.

The HSO has the authority and responsibility to stop work at any time conditions are determined to present an unsafe work environment.

The on-site HSO will be responsible for performing radiation screening and classification of samples prior to shipment to the laboratory. This effort will also include classifying samples to indicate whether they meet U.S. Department of Transportation (DOT) and International Air Transport Association (IATA) shipping requirements and whether they can be accepted by the laboratory under the licensing agreements.

2.5.4 IT Project Superintendent

The IT Project Superintendent for the remedial action is

Mr. Thomas Pugh
IT Corporation
2790 Mosside Blvd.
Monroeville, Pennsylvania 15146-2792

The Project Superintendent will report directly to the IT Project Manager and is responsible for

- Implementation plans and specifications for the remedial action

- Assuring that personnel under his supervision have required training
- Directly supervising technical staff and subcontractors in the performance of remedial activities to ensure compliance with the ADEC-approved Site Assessment and Remedial Action Plan
- Maintaining all schedule commitments

2.5.5 IT Sampling and Analysis Supervisor

The IT Sampling and Analysis Supervisor (SAS) for the Project Chariot: 1962 Tracer Study site assessment and waste sampling is

Mr. Jeffrey J. Tasca
IT Corporation
165 Fieldcrest Avenue
Edison, New Jersey 08837

The SAS will report directly to the IT Project Manager and is responsible for

- Assuring that personnel under his supervision have required training prior to performing activity
- Assuring that all activity is accomplished in accordance with established plans and procedures
- Supervising field sampling teams, radiological survey teams, and on-site laboratory operations
- Scheduling and coordinating sampling and surveying activities
- Coordinating sample handling and shipping
- Reviewing field documentation.

2.5.6 IT Field Sampling and Radiological Survey Teams

The sampling and survey teams will be responsible for conducting the daily activities necessary for completion of the sampling and monitoring efforts. All team members will be responsible for compliance with project documents (e.g., Standard Operating Procedures (SOPs), QAPjP, and SSHASP). Responsibilities include

- Performing assigned sampling and surveying activities in accordance with established plans and procedures
- Maintaining field instruments and equipment, and identifying and segregating faulty equipment
- Performing field screening procedures
- Providing project support to help ensure all project activities are accomplished in a manner conducive to high quality job performance
- Documenting activities on the appropriate field forms.

2.5.7 Off-Site Laboratory Director

The Laboratory Director is responsible for the oversight of the laboratory operations and for the scheduling of staff and laboratory activities to meet the time requirements of the project. Other responsibilities include

- Release of testing data and results
- Supervision of data verification
- Notification of project, laboratory, and QA staff of nonconformances and variances
- Provide interface between the project field personnel and the laboratory
- Provide assistance to project staff relating to sample containers, preservation, shipping, and storage requirements
- Provide appropriate protocols and ensure their proper implementation.

3.0 Quality Assurance Objectives for Measurement Data

QA objectives have been stipulated to ensure that the sample data are meaningful and valid and can withstand scientific and legal scrutiny. Data shall be collected in accordance with procedures appropriate for the intended use of the data. The QA objectives, as relates to sample collection and laboratory analytical efforts, include precision, accuracy, representativeness, completeness, and comparability.

The analytical parameter list and types of samples to be collected are presented in the FSP. Specific QA objectives are discussed in detail in the following sections.

Because analyses will be performed at both an on-site laboratory and an off-site laboratory, QA objectives for each lab are provided. The objectives for the on-site laboratory are, by necessity, less stringent due to the conditions under which the laboratory will operate. There is the strong possibility that temperature and power fluctuations in the on-site facility may affect operations. The off-site laboratory is not subject to these adverse conditions.

3.1 Precision

Precision measures the reproducibility of measurements under a given set of conditions. Precision shall be expressed in terms of the relative percent difference (RPD) between duplicate samples or replicate analyses. The precision goals for each parameter at each lab are presented in Table 3-1.

Measurement system precision shall be controlled through laboratory-internal analytical replication and by the analysis of field duplicate samples. One laboratory duplicate sample shall be analyzed for every 20 samples, or a minimum of one per day if less than 20 are analyzed in a single day. Precision data shall be plotted on control charts daily.

3.2 Accuracy

Accuracy measures describe the bias in a measurement system (EPA, 1987). For this project, accuracy will be calculated as percent recovery (%R) for all analytical parameters. Accuracy goals have been established for both laboratories and are presented in Table 3-1.

Sources of error in accuracy can be from inadequate or inconsistent field sampling techniques; therefore, sampling will be conducted following established SOPs. The field program is

Table 3-1
Project Chariot Remedial Action Sampling Program Quality Assurance Objectives

Parameter	Medium	Analytical Method	Analytical Equipment	Typical Precision RPD Percent	Typical Accuracy Recovery Percent	Completeness Percent	Minimum Detectable Concentration
ON-SITE LABORATORY							
Gamma Spectroscopy (based on Cs-137)	Soil	HASL 300, 4.5.2.3[a]	Intrinsic Germanium Detector	± 30	70-130	95	1 pCi/g
OFF-SITE LABORATORY							
Gross Alpha	Soil	SM 7110[a]	Proportional Counter	± 25	75-125	95	1 pCi/g
	Sediment	SM 7110	Proportional Counter	± 25	75-125	95	1 pCi/g
	Water	EPA 900.0[b]	Proportional Counter	± 25	75-125	95	4 pCi/L
Gross Beta	Soil	SM 7110	Proportional Counter	± 25	75-120	95	1 pCi/g
	Sediment	SM 7110	Proportional Counter	± 25	75-120	95	1 pCi/g
	Water	EPA 900.0	Proportional Counter	± 25	75-120	95	4 pCi/L
Gamma Spectroscopy (based on Cs-137)	Soil	HASL 300, 4.5.2.3[c]	Intrinsic Germanium Detector	± 20	80-120	95	0.6 pCi/g
	Sediment	HASL 300, 4.5.2.3	Intrinsic Germanium Detector	± 20	80-120	95	0.6 pCi/g
	Water	EPA 901.1	Intrinsic Germanium Detector	± 20	80-120	95	10 pCi/L
	Biota	HASL 300, 4.5.2.3	Intrinsic Germanium Detector	± 20	80-120	95	To be determined
Sr-90	Soil	EPA 904.0	Proportional Counter	± 20	80-120	90	1 pCi/g
	Sediment	EPA 904.0	Proportional Counter	± 20	80-120	90	1pCi/g
	Water	EPA 904.0	Proportional Counter	± 20	80-120	90	4 pCi/L
	Biota	EPA 904.0	Proportional Counter	± 20	80-120	90	1 pCi/g
Pu-239	Soil	NAS-NS 3058[e]	Alpha Spectroscopy	± 25	75-125	90	1 pCi/g
	Sediment	NAS-NS 3058	Alpha Spectroscopy	± 25	75-125	90	1 pCi/g
	Water	NAS-NS 3058	Alpha Spectroscopy	± 25	75-125	90	.07 pCi/L
	Biota	NAS-NS 3058	Alpha Spectroscopy	± 25	75-125	90	1 pCi/g
Am-241[d]	Soil	NAS-NS 3006	Alpha Spectroscopy	± 25	75-125	90	1 pCi/g
	Sediment	NAS-NS 3006	Alpha Spectroscopy	± 25	75-125	90	1 pCi/g
	Water	NAS-NS 3006	Alpha Spectroscopy	± 25	75-125	90	.06 pCi/L
	Biota	NAS-NS 3006	Alpha Spectroscopy	± 25	75-125	90	1 pCi/g
Parameter	**Medium**	**Analytical Method**	**Analytical Equipment**	**Typical Precision RPD Percent**	**Typical Accuracy Recovery Percent**	**Completeness Percent**	**Practical Quantitation Limits**
Volatile Organics	Soil	USEPA 8240	Gas Chromatograph/ Mass Spectrometer	± 25	59-172	80	See Table 7-1
Semivolatile Organics	Soils	USEPA 8270	Gas Chromatograph/ Mass Spectrometer	± 50	11-142	80	See Table 7-2
Parameter	**Medium**	**Analytical Method**	**Analytical Equipment**	**Typical Precision RPD Percent**	**Typical Accuracy Recovery Percent**	**Completeness Percent**	**Method Detection Limit**
Metals	Soil	USEPA 6000-7000	ICP, CVAA	± 20	80-120	80	See Table 7-5
PCBs	Soil	USEPA 8080	Gas Chromatograph	± 40	38-131	80	See Table 7-6

[a]Standard Methods for the Examination of Water and Wastewater, American Public Health Association.
[b]Prescribed Procedures for Measurement of Radioactivity in Drinking Water, U.S. EPA
[c]Environmental Measurements Laboratory Procedure Manual HASL-300, U.S. DOE
[d]Note: Am-241 cannot be quantified by means of low-energy gamma spectroscopy due to matrix interference, chemical separation and counting by alpha spectroscopy will be performed
[e]National Academy of Science

designed to minimize potential for error. One of the ways error will be minimized is through use of clean sampling equipment. Sampling equipment shall be thoroughly cleaned. The sampling equipment shall be surveyed with portable radiation survey instruments and test wipes collected and counted to verify cleanliness. Sampling accuracy will be assessed through analysis of field and laboratory blanks.

Quality Control (QC) spike samples shall be analyzed by the off-site laboratory to determine the actual accuracy achieved by analytical processes. QC standards will be counted on gamma spectroscopy systems to determine accuracy. The on-site laboratory will count a Cs-137 quality control standard, approximately twice the activity of the required detection limit between each sample, until it can be determined that the system is not being adversely affected by environmental changes. This frequency may be changed with the approval of the designated senior analytical advisor and the QAO, following review of the QC data obtained. Accuracy data shall be plotted daily on control charts.

3.3 Representativeness

Representativeness expresses the degree to which sample data represents a characteristic of a population, parameter variations at a sampling point, or an environmental condition (EPA, 1987). Sample representativeness will be achieved through the definition of a clear and consistent sampling program, as presented in the FSP. Sample locations have been chosen to satisfy data quality needs for the Project Chariot: 1962 Tracer Study site assessment and remedial action, and are also presented in the FSP. The sampling program is designed to collect the following

- Samples representative of soil from excavation activities, undisturbed background locations, the excavated clean area, and identified test plots
- Surface water and sediment samples representative of conditions in the areas where experiments were conducted
- Representative sampling of wastes
- Biological samples representative of selected biota of the Chariot Site environs from sampling locations established in earlier studies.

3.4 Completeness

Completeness is defined as a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected under correct normal conditions.

Sample data completeness shall be achieved through quality sampling practices and the application of appropriate analytical techniques and data documentation. Collocated samples shall be collected at each location for environmental and waste samples. Replicate samples shall be collected at each biological sampling location and within each sample type. Therefore, it is anticipated that a high percentage of completeness is achievable. The completeness objectives are presented in Table 3-1 for each parameter and matrix.

3.5 Comparability

Comparability is a qualitative parameter expressing the confidence with which one data set can be compared with another (EPA, 1987). Each sample type shall be sampled using established procedures, and the data obtained from different sampling points shall be comparable. Biological samples shall be collected using techniques consistent with studies performed during 1959-1961 and shall be comparable to results from those studies.

4.0 Field Investigations

Field investigations for Project Chariot: 1962 Tracer Study site assessment and remediation activities include sampling and surveying for radioactivity. The site assessment shall consist of biological, sediment, and water sampling, as well as radiological sample screening and site survey operations. Remedial activities shall include waste profile characterization, post excavation soil sampling of the excavated mound site, and background sampling. The waste characterization sample analyses shall include hazardous waste constituents that cannot reasonably be excluded as concerns.

4.1 Sample Collection

Rationale for selection of sampling site and specific procedures for sample collection are discussed in the FSP and associated SOPs. Collocated samples shall be collected for soil, water, and sediment samples. These samples shall be obtained from each location, and one of each pair of samples shall be archived for use as a back-up sample.

Environmental sample collection data shall be documented on a Sample Collection Log (Figure 4-1). Entries to the log shall include those specified in SOP-CHR-02.

Biological sample collection data shall be documented on a form specific to the biological sampling effort (Figure 4-2).

A description of sample containers, preservatives, and holding times is presented in the FSP (Table 6-1). Procedures for sample handling and shipping are provided in more detail in the SOP-CHR-01.

To avoid sample contamination, sample containers will be one-time-use containers. Sampling equipment shall be properly cleaned between uses in accordance with SOP-CHR-04.

4.2 Radiological Monitoring

The radiological field screening of the mound surface, test plots, and soil samples shall be performed in accordance with approved procedures and documented on the Radiological Survey form provided in the instrument specific SOP. Procedures shall provide instructions for the use of specific instruments required to accomplish these activities. All surveys shall be entered on a Radiological Survey Log (Figure 4-3).

INTERNATIONAL
TECHNOLOGY
CORPORATION

DATE	
TIME	
PAGE ____ OF ____	
PAGE	
PROJECT NO.	

SAMPLE COLLECTION LOG

PROJECT NAME ______________________________

SAMPLE NO. ______________________________

SAMPLE LOCATION ______________________________

SAMPLE TYPE ______________________

COMPOSITE ____ YES ____ NO

COMPOSITE TYPE ______________________

DEPTH OF SAMPLE ______________________

WEATHER ______________________

CONTAINERS	AMOUNT COLLECTED

COMMENTS:

PREPARED BY: ______________________

Figure 4-1
Environmental Sample Collection Log

Biological Sample Collection Log

Project ID ______________ Sample No. ______________
Location ______________ Code No. ______________
Collection Date ________ Time ________ Day of Year ______ Area Sampled ________ Volume Sampled ________
Sample Type ______________
Field Notes ______________

Signature:

Sample Sec.	Field Wet Wt.	Lab. Wet Wt.	Air Dry Wt.	Square Meter
(1)				
(2)				
(3)				
Initials/Date				
		ml of H_2O added		

Ratios: Lab. Wet/Lab. Wet + H_2O ________
Field Wet/Air Dry ________ Lab. Wet/Air Dry ________

STANDARD WEIGHT DETERMINATION

Wet Sample Aliquot — Wet ________ = ________
(~13g wet tissue, ~3.5g bone) — Std. Ash
Gross ________
Tare ________
Net ________
Corrected Net ________ Initials/date ________

Air Dry Sample Aliquot (~4g)
Gross ________
Tare ________
Net ________

Standard Dry Weight — Std. Dry / Air Dry ________ = ________
Gross ________
Tare ________
Net ________ Initials/date ________

Standard Ash Weight — Std. Dry / Wet ________ = ________
Gross ________
Tare ________
Net ________ Initials/date ________

WEIGHTS OF MUFFLED SAMPLE

Wet		Air Dry	Weight of Ash
(1)	Gross		
	Tare		
	Net		
	Corrected Weight		
(2)	Gross		
	Tare		
	Net		
(3)	Gross		
	Tare		
	Net		
(4)	Gross		
	Tare		
	Net		
(5)	Gross		
	Tare		
	Net		
TOTAL WEIGHT			

Counted Sample Container # ______ # ______ # ______

	Wet	Dry	Ash
Gross			
Tare			
Net			

Process Remarks: ______________

Figure 4-2
Biological Sample Collection Log

INTERNATIONAL
TECHNOLOGY
CORPORATION

RADIOLOGICAL SURVEY FORM

Survey Number	Survey		Survey By	Description
	Date	Time		

Figure 4-3
Radiological Survey Log

4.3 Field Activity Documentation

Complete documentation of field activities, sample collection, and radiation monitoring records is required to verify the quality of work performed in the field. Documentation must include sufficient, relevant, and accurate detail to establish that requirements were satisfied.

All documents generated during the Project Chariot: 1962 Tracer Study site assessment and remedial action shall be completed with black indelible ink. Mistakes shall be corrected by marking one line through the mistake and initialing and dating beside the correction.

The IT Project Manager, or a designee, shall maintain a bound logbook with consecutively numbered pages. Each page shall be dated and signed when completed. Entries shall include detailed information on activities performed each day and relevant administrative decisions. Each field activity unit shall record details of the activity on a Field Activity Daily Log (FADL) (Figure 4-4).

FADLs shall provide pertinent information on specific field activities. Entries in the log shall include those specified in SOP-CHR-02 which include:

- The names and affiliations of field personnel and visitors to the site
- A general description of the day's field activities showing the chronological sequence of events. It is preferable to use the military method of noting time (e.g., 9:00 am is 0900 and 5:00 pm is 1700)
- Documentation of weather conditions and any significant changes during the day
- Field equipment calibration data and identification of the standard(s). Alternatively, this data may be recorded on a Calibration Log with a reference to the log placed in the FADL
- Field measurements, such as temperature, wind speed and direction, and readings from personnel safety instruments and monitoring equipment. Measurements must always include units
- References to appropriate field data forms for details of each activity performed
- Field equipment identification, such as type, manufacturer, serial number, and model number
- Problems encountered

INTERNATIONAL TECHNOLOGY CORPORATION

FIELD ACTIVITY DAILY LOG

DAILY LOG				
	DATE			
	NO.			
	SHEET OF			

PROJECT NAME	PROJECT NO.
FIELD ACTIVITY SUBJECT:	
DESCRIPTION OF DAILY ACTIVITIES AND EVENTS:	
VISITORS ON SITE:	CHANGES FROM PLANS AND SPECIFICATIONS, AND OTHER SPECIAL ORDERS AND IMPORTANT DECISIONS.
WEATHER CONDITIONS:	IMPORTANT TELEPHONE CALLS:
IT PERSONNEL ON SITE:	
SIGNATURE	DATE:

327A-7-86

Figure 4-4
Field Activity Daily Log

- Procedure variances
- Corrective actions taken and the result.

All forms must be signed and dated by the person preparing the record. The form must be completed with no blanks left on the form. Not applicable (NA) shall be entered where information requested is not applicable to the site or work being performed.

As part of field activities, photographic and videotape records shall be prepared as described in the FSP, Appendix A, SOP-CHR-06, "Field Activity Photographs." Photographs and videos should record the significant characteristics of the activity, such as general site layout, geologic features, environmental impacts, field equipment, sampling stations, and waste containerization. A log shall be kept of photographs and video tapes being made (Figure 4-5) with the project number, date taken, and a brief description recorded on the back of each photograph or the label of the videotape.

Completed video tapes shall be sealed with a custody seal and maintained in a controlled manner by the originator. Each sealed tape shall be submitted to the Project Manager, or designee, for secure filing on the site. The security tape must be initialed and dated by the originator.

Task Supervisors shall review field records for the tasks under their supervision. Reviewed records shall be submitted to the Site Files Administrator for maintenance until completion of the field program, at which time they shall be transferred to the central project files. Records shall include the documentation of field activities, sample collection, and monitoring records.

INTERNATIONAL TECHNOLOGY CORPORATION

PHOTOGRAPHIC LOG

Page ____ of ____

PROJECT NAME ____________________ CAMERA MODEL ____________________

PROJECT NUMBER ____________________ SERIAL NUMBER ____________________

PHOTOGRAPHER ____________________ FILM FORMAT: SLIDES ☐ PRINTS ☐

SITE ENGINEER(S) ____________________ SIZE: ________ SPEED: ________

____________________ COMMENTS ____________________

ROLL NUMBER ____________________ ____________________

FRAME / NEG. Ⓐ	DIRECTION Ⓑ	DATE Ⓒ	TIME Ⓓ	DESCRIPTION (Location, features, personnel)

Ⓐ FRAME is the exposure number displayed on the camera.
NEG. is the number identification on the negative (as applicable)

Ⓑ One of eight compass directions (e.g. northwest) should be used to describe the direction the camera is pointed. Alternatively an azimuth or relative orientation to a known datum may be used

Ⓒ The date is expressed for month/day/year.

Ⓓ Time is documented using the 24 hour clock.

Figure 4-5
Photographic Log

5.0 Sample Custody

Chain-of-Custody (COC) procedures shall be used to create an accurate written record of the possession and handling of each sample. SOP-CHR-01, "Sample Control and Documentation," provides detailed instructions that must be followed during the collection of all Project Chariot: 1962 Tracer Study site assessment and remedial action samples.

Use of a COC form is required, without exception, to create a traceable written record of the sample from the time of collection through laboratory disposal (EPA, 1978). A sample is considered in custody if it

- Is in a person's actual possession
- Is in view after being in the person's physical possession
- Was in one's physical possession but is now in a secured area to prevent tampering
- Is in a designated secured area, restricted to authorized personnel only.

The following forms will be used in conjunction with the COC process for sample tracking and field activities.

- Sample Collection Log
- Sample identification labels
- Custody seals.

5.1 Chain-of-Custody/Request for Analysis Record Form

Chain-of-Custody/Request for Analysis (COC/RFA) Record forms shall be preprinted with a unique COC control number in the upper right-hand corner. The original must accompany the samples to the lab, and the duplicate field copy shall be retained by sampling personnel and submitted to the project files. An example of the combination COC/RFA form to be used for this project is shown in Figure 5-1.

The COC/RFA shall be initiated by field personnel responsible for collecting and transporting samples. The form shall be filled out completely and include the information specified in SOP-CHR-01. The information includes

- Unique sample number and sample description
- Project name and number
- Date and time of sample collection
- Container type, sample volume, and preservatives used
- Analysis requested
- Signature of sampling team member

INTERNATIONAL TECHNOLOGY CORPORATION

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD*

Reference Document No. 404806
Page 1 of ___

Project Name/No. [1]
Sample Team Members [2]
Profit Center No. [3]
Project Manager [4]
Purchase Order No. [6]
Required Report Date [11]

Samples Shipment Date [7]
Lab Destination [8]
Lab Contact [9]
Project Contact/Phone [12]
Carrier/Waybill No. [13]

Bill to: [5]

Report to: [10]

ONE CONTAINER PER LINE

Sample Number [14]	Sample Description/Type [15]	Date/Time Collected [16]	Container Type [17]	Sample Volume [18]	Pre-servative [19]	Requested Testing Program [20]	Condition on Receipt [21]	Disposal Record No. [22]

Special Instructions: [23]

Possible Hazard Identification: [24]
Non-hazard ❑ Flammable ❑ Skin Irritant ❑ Poison B ❑ Unknown ❑

Sample Disposal: [25]
Return to Client ❑ Disposal by Lab ❑ Archive (mos.)

Turnaround Time Required: [26]
Normal ❑ Rush ❑

QC Level: [27]
I. ❑ II. ❑ III ❑ Project Specific (specify):

1. Relinquished by [28] (Signature/Affiliation)	Date: Time:	1. Received by [28] (Signature/Affiliation)	Date: Time:
2. Relinquished by (Signature/Affiliation)	Date: Time:	2. Received by (Signature/Affiliation)	Date: Time:
3. Relinquished by (Signature/Affiliation)	Date: Time:	3. Received by (Signature/Affiliation)	Date: Time:

Comments: [29]

White: To accompany samples
Yellow: Field copy
*See back of form for special instructions

Figure 5-1
Example of Chain-of-Custody/Request for Analysis Form

- Laboratory designation and contact
- Chain-of-custody control numbers including carrier/waybill number (if applicable)
- Signature and date of personnel relinquishing or receiving sample custody
- Name and phone number of project contact person
- Possible hazard identification.

If it is necessary to split field sample sets for shipment to separate laboratories, a new set of shipping COC forms must be generated referencing the original field chain of custody. Sample information on the original field COC form shall not be deleted, marked out, or obscured in any way. The original entry must be referenced to the new COC form. Copies of the original field COC forms must be attached to the new shipping COC forms. The original field COC form number must be referenced on the shipping COC form. Collocated samples shall be documented on COC/RFA forms. Archiving of these samples shall be in a secured area to maintain custody requirements.

5.2 Sample Labels and Identification

Samples shall be labeled (see Figure 5-2) in the field with a black waterproof marker with the sample number, location, time, date, and sampler's initials. If necessary, samples will then be taken to a clean, predesignated sample preparation area for permanent labeling with black waterproof ink. Sample identification shall include, as a minimum the information specified in SOP-CHR-01 which includes the following

- Project name
- Unique sample number
- Sampling location (grid location, excavation locations, and field coordinates)
- Sampling date and time
- Individual performing sampling
- Preservation or conditioning.

5.3 Custody Seals

When samples are shipped to the off-site laboratory, they shall be placed in containers and sealed with custody seals. Two or more seals shall be placed on each shipping container, with at least one at the front and one at the back. These seals shall be located in a manner that would indicate if the containers were opened in transit. Clear shipping tape, or equivalent shall be placed over the seals to ensure that the seals are not accidentally broken during shipment, while remaining visible. Completely covering the seal with this type of tape will ensure that the label cannot be peeled off. (See Figure 5-3 for example of custody tape.)

INTERNATIONAL TECHNOLOGY CORPORATION

F
H R

Project Name ____________________

Project No. ____________________

Sample No. ____________________

Collection Date/Time ____________________

Collector's Name ____________________

Sample Location ____________________

Sample Type/Depth/Description ____________________

Analyze For __________ Preservative __________

Bottle ______ of ______ ______ Filtered ______ Nonfiltered

23-8-85

Figure 5-2
Sample Label

SAMPLES
INTERNATIONAL TECHNOLOGY
ANALYTICAL SERVICES

IT

SAMPLES
INTERNATIONAL TECHNOLOGY
ANALYTICAL SERVICES

Figure 5-3
Sample Custody Tape

5.4 Shipping Procedures

Samples shall be packed for shipment in containers (sturdy coolers) as follows and graphically presented in Figure 5-4.

- Tape the interior and exterior shipping container drain plug so that it will not open or leak if samples are broken in transit
- Line the shipping container with a large polyethylene (garbage) bag
- Place a layer of vermiculite (or bubble wrap for solid samples) at the bottom of the shipping container
- Verify that the properly completed sample label is attached to each sample container
- Verify that each sample container is in a sealed Ziploc® or similar plastic bag
- Place sample containers and with ice packages in baggies and/or Blue Ice® sufficient for cooling to 4 degrees Celsius (°C) (40° Farenheit [°F]) in the shipping container
- Pour vermiculite around each sample container to minimize the possibility of breakage
- Place original COC/RFA record in a plastic sealable bag and tape the bag to the inside of the shipping container lid
- Secure both ends of the shipping container with clear shipping tape, or equivalent placing custody seals beneath tape at opposite ends so that it cannot be opened without breaking the seal
- Attach labels with arrows indicating the top side up on all four sides of the shipping container
- Notify laboratory when samples are shipped and provide expected delivery date.

These shipping procedures are for samples that are not considered hazardous and do not meet the definition of radioactive materials as defined by DOT 49 C.F.R. Part 173.403 or IATA Section 6.

Specific requirements for handling and shipping of radioactive samples are given by the DOT regulations in 49 C.F.R. Parts 170-179 or IATA Section 6. Guidance on radioactive sample handling and shipping is presented in the SAP, Appendix A, SOP-CHR-05, "Shipment of Remedial Action Derived Waste."

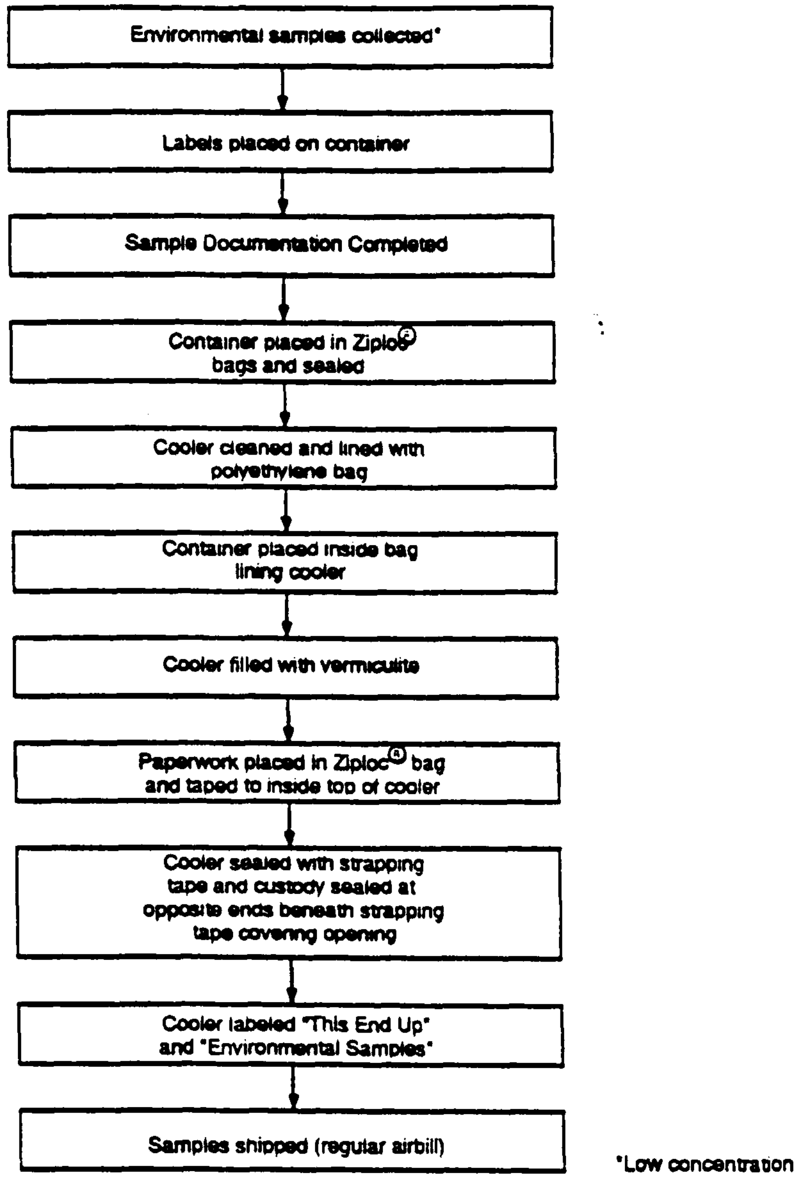


Figure 5-4
Activity Flow of Sample Handling, Packaging, and Shipping Procedures

6.0 Calibration Procedures and Frequency

Measuring and test equipment used on this project shall be calibrated following documented and approved procedures. The IT Project Manager is responsible for assuring that all field equipment (including monitoring equipment) is in calibration prior to use.

All test and measuring equipment shall be uniquely identified by the manufacturer's serial number, and records shall reference the unique identification. Calibration records for field equipment and reference standards shall be kept in the project files.

Field equipment requiring periodic calibration shall be calibrated by the manufacturer or an approved agency using industry standard procedures (e.g., American Society for Testing and Material [ASTM]) or manufacturer-recommended methods prior to initiation of field activities. Approved procedures shall be used for daily field calibration checks of measurement and test equipment. A "calibration check" consists of measuring a reference standard and confirming that the response of the instrument is within an accepted range. Field calibration checks shall be documented on forms specified by procedure.

Some of the measuring and test equipment to be used for field investigation or in the laboratory will be calibrated as part of its operational use. For this equipment, records of the calibrations or checks will be documented as part of the test data, such as on an air monitoring log, calibration log, or test data form.

6.1 Calibration Frequency

Frequency of calibration is based upon the type of equipment, inherent stability, manufacturer's recommendations, national standard recommendations, intended use, effect of error on the measurement process, and experience. A list of equipment types and the required calibration frequency is provided in Table 6-1.

The periodic calibrations shall be accomplished in the weeks just prior to initiation of field activities. Calibration checks shall be performed during readiness review activities, at the Project Chariot Site, and before use.

Table 6-1

Field Equipment Calibration Frequencies and Standards

Equipment	Calibration Frequency		Standards
Ludlum® Model 44-9 Geiger-Mueller (G-M) Pancake Probe with the Ludlum® Model 3 Survey Meter	1 year	Daily	Cs-137 for Beta and Gamma
Ludlum® Model 43-5 Alpha Scintillation Probe with the Ludlum® Model 12 Count Ratemeter	1 year	Daily	Th-230 for Alpha
Horiba U-10 Water Quality Checker	1 time before use		Auto-calibration: Horiba standard phthalate pH solution for all tests Manual (two-point) calibration (required for new probes): pH buffer solutions pH values of 4.0, 7.0, and 10.0 for pH, KCl solution for conductivity Hydrazine sulfate, deionized or distilled water and hexamethylenetetramine for turbidity. Deionized or distilled water for turbidity. 800 NTV standard solution for trubidity spoon Sodium sulfite and deionized or tap water for dissolved oxygen (DO) zero calibration Oxygen-saturated spoon solution for DO spoon calibration Any gas mixture or liquid having a stable and known oxygen partial pressure for DO and calibration
Global Positioning System	Per manufacturer's instructions		Calibrated in accordance with manufacturer's instructions Radiation sources: Ra-225; Co-60
Ludlum® Model 2929/43/10-1 Smear Counter	1 year	Daily	
Reuter-Stokes pressurized ion chamber (PIC)	1 year	Daily	Cs-137 for Beta and Gamma
Eberline ESP-2 ratemeter with 3 by 3-inch sodium iodide (NaI) detector	1 year	Daily	Cs-137 for Beta and Gamma
Canberra Portable Multichannel Analyzer (MCA), or equivalent with 3 by 3-inch NaI detector	1 year	Daily	

6.2 Reference Standards

Equipment shall be calibrated using reference standards having known relationships to nationally recognized standards, such as the National Institute of Standards and Technology (NIST) standards. Standards must be documented on calibration certificates and maintained in the project files on site.

6.3 Calibration Failure

It is the responsibility of each individual using equipment to check the calibration status of the equipment to be used and confirm current calibration prior to use. Equipment for which the calibration period has expired, equipment that fails calibration, or equipment that becomes inoperable during use shall be removed from service, tagged, and physically segregated from other equipment. Such equipment shall be repaired and/or recalibrated to the satisfaction of the Site Superintendent prior to being returned to service.

7.0 Analytical Procedures

Table 3-1 lists the individual analytical parameters and their respective minimum detectable concentrations for each parameter and matrix. The individual preparation, extraction, and analytical methods are described in the laboratory procedures. The parameters and their respective analytical methods are also shown in Table 3-1.

7.1 Laboratory Analysis

On-site laboratory analyses for Project Chariot 1962 Site Remedial Action shall be direct counting of soils by gamma spectral analysis. Off-site laboratory radiological analyses shall include gamma spectral analyses for confirmation of on-site laboratory results, gross alpha and gross beta counting, and isotopic analysis as indicated from screening results. All waste profile characterization analyses shall be performed by the off-site laboratory.

All analyses, at both on-site and off-site laboratories, shall be performed in accordance with written, approved work instructions by trained personnel using properly calibrated equipment.

A qualified radioanalytical specialist shall be designated and shall be consulted by phone on any analytical problems that arise during the project. Any changes to the on-site analytical program must be first reviewed and approved by the qualified radioanalytical specialist and the QAO.

7.2 Analysis Performance

The on-site laboratory shall be the responsibility of the Sampling and Analysis Supervisor and the Laboratory Group Leader. The Group Leader shall be responsible for the completion and review of data sheets and associated calculations.

The scheduling and execution of the off-site laboratory program shall be the responsibility of the Laboratory Director. As part of the testing program, the Laboratory Director or designee shall also be responsible for the completion, checking, and organization of laboratory data sheets and calculations and reporting of test results to project personnel.

The generation of laboratory data shall follow a standard laboratory program management scheme, which consists of five major areas. Each of these areas are discussed in the following sections.

7.2.1 Test Program Initiation

The following information must be communicated to the laboratory contacts prior to mobilization of field activities.

- Project requirements and field sampling and laboratory testing data quality parameters, including quality level of test data, equipment, test parameters, sampling procedures, quality control samples, and test method selection
- Requests for required sample containers
- Preparation of sample containers and preservatives
- Sample shipping containers.

7.2.2 Sample Receipt

Upon receipt of samples at the off-site laboratory, laboratory SOP-SL2001, "Chain-of-Custody" and SOP-SL2002, "Sample Receipt" shall be followed. This includes documentation of the change of custody, and inspection and surveying of the shipping containers for radioactive contamination. Confirmation of receipt of samples shall be phoned or faxed to the IT Project Manager.

The on-site laboratory shall use the original COC form to maintain the record of custody within the laboratory and shall maintain a log of those samples submitted for analysis.

7.2.3 Laboratory Testing

Following log-in of project samples, laboratory personnel shall

- Review holding times and the amount of sample available, and prioritize analyses
- Perform analyses specified by project requirements, within applicable holding times and according to accepted procedures (e.g., EPA and ASTM)
- Perform all appropriate quality control checks, including calibration as required by procedure
- Record pertinent data and observations on laboratory data sheets.

Constituents of concern and analytical methods to be used for this project are provided in Table 3-1 and Tables 7-1 through 7-4. Instances may arise where high sample concentrations,

Table 7-1
Analytical Parameter List for Volatile Organics Regulatory Levels (RL) and Practical Quantitation Limits (PQL)

Analyte	RL (mg/L)	Total Soil Detection Limit Equivalent (mg/kg)	PQL (mg/kg)a
Benzene	0.5	10	0.005
Carbon Tetrachloride	0.5	10	0.005
Chlorobenzene	100.0	2000	0.005
Chloroform	6.0	120	0.005
1,2 - dichloroethane	0.5	10	0.005
1,1 - dichloroethylene	0.7	14	0.005
Methyl-ethyl-ketone	200.0	4000	0.010
Tetrachloroethylene	0.7	14	0.005
Trichloroethylene	0.5	10	0.005
Vinyl chloride	0.2	4	0.010

[a]EPA Method 8240

Table 7-2
Analytical Parameter List for Semivolatile Organics Regulatory Levels (RL) and Practical Quantitation Limits (PQL)

Analyte	RL (mg/L)	Total Soil Detection Limit Equivalent (mg/kg)	PQL (mg/kg)
o-cresol	200	4000	0.66
m-cresol	200	4000	0.66
p-cresol	200	4000	0.66
Cresol a	200	4000	0.66
1,4 - dichlorobenzene	7.5	150	0.66
2,4 - dinitrotoluene	0.13	2.6	0.66
Hexachlorobenzene	0.13	2.6	0.66
Hexachloro-1,3-butadiene	0.5	10	0.66
Hexachloroethane	3.0	60	0.66
Nitrobenzene	2.0	40	0.66
Pentachlorophenol	100	2000	3.3
Pyridine	5.0	100	0.66
2,4,5-trichlorophenol	400	8000	0.66
2,4,6-trichlorophenol	2.0	40	0.66

[a]EPA Method 8270
[b]If m-cresol and p-cresol are unresolved, report total cresol

Table 7-3
Analytical Parameter List for Total Metals Regulatory Levels (RL) and Method Detection Limits (MDL)

Analyte	RL (mg/L)	Equivalent Soil RL (mg/kg)	MDL (mg/kg)a
Arsenic	5.0	100	50
Barium	100.0	200	1
Cadmium	1.0	20	1
Chromium	5.0	100	2.5
Lead	5.0	100	15
Mercury	0.20	4.0	0.1
Selenium	1.0	20	0.3
Silver	5.0	100	100

[a]Selenium will be analyzed by graphite furnace using EPA Method 7740; Mercury will be analyzed by cold vapor atomic absorption with EPA Method 7470; all other metals will be analyzed by inductively coupled plasma-atomic spectroscopy with EPA Method 6010.

Table 7-4
Analytical Parameter List for PCBs Regulatory Levels (RL) and Method Detection Limits (MDL)

Analyte	Acceptance Level (ppm)	MDL (mg/kg)a
Aroclor 1016	50	1.0
Aroclor 1221	50	1.0
Aroclor 1232	50	1.0
Aroclor 1242	50	1.0
Aroclor 1248	50	1.0
Aroclor 1254	50	1.0
Aroclor 1260	50	1.0

[a]EPA Method 8080

nonhomogeneity of samples, or matrix interferences preclude achieving the state detection limits or associated quality control criteria. In such instances, the reason for deviations that result in a nonconformance shall be reported on a laboratory nonconformance report (NCR). All NCRs shall be communicated to the IT Project Manager verbally and documented in the written report.

7.2.4 Laboratory Data Verification

Data verification is a systematic process of reviewing a statistically significant portion of the data to achieve an acceptable level of confidence that the data are in compliance with all relevant criteria.

Data verification in the off-site lab consists of the following

(1) Primary Data Verification - the reviewing of a minimum of 20 percent of the data. This verification is performed by qualified laboratory personnel other than those performing the original work. If discrepancies are identified by this review, internal data validation must be performed on all data reports from the sample batch.

(2) Secondary Data Verification - reviewing 5 percent of the data. This verification is performed by Quality Assurance personnel, or other qualified personnel. If discrepancies are determined by this review, internal data validation must be performed on all data reports.

The on-site laboratory sample data shall be reviewed by lab staff not involved in performing the work or by the QAO.

7.2.5 Data Reporting

Data is released by the off-site laboratory Document Control Coordinator to the Data Entry group for compilation on the appropriate report format and electronic data transfer (EDT). All data shall be prepared and checked per written approved procedures, which require that the draft report be checked by a second person and that 100 percent of the numbers are checked. Final release of lab reports is the responsibility of the Laboratory Director.

When EDTs are prepared, a hard-copy printout of data for each sample shall be generated and checked, by 100 percent comparison to the raw data, by a second person that did not enter the data.

The on-site lab data reports shall be reviewed and approved by the Sampling and Analysis Supervisor or a designee.

8.0 Data Reduction, Verification, Validation, and Reporting

8.1 Data Reduction Verification

Computations performed on raw data are considered data reduction. This includes, but is not limited to, summary tables, statistics (i.e., means, standard deviations, variances, standard errors, and confidence limits), and other numerical checks.

Numerical reduction of data shall be formally checked using the standard IT checkprinting process. Check printing must be performed prior to presentation of results. A subsequent calculation should not reference or use information from a calculation that has not been checked.

Verification of data reduction is the responsibility of project personnel. Checking must be performed by an individual(s) other than the person performing the original work. Assignment of a checker must be made by the Project Manager based upon the technical complexity of the computation and the experience of personnel performing and checking the reduction.

The data verification process performed by the laboratory shall include reviewing laboratory efforts to show that proper analytical methods were used, detection limits were appropriate, the data are accurate, the proper number of significant figures were reported, and the data were calculated properly. Data verification must also include a review of analytical instrument calibration and ensure that proper standards were prepared and used during calibration. Laboratory data shall be reviewed for completeness. All data reduction verification shall be documented and maintained in the project files.

8.2 Calculation Verification

Documentation of calculation (calculation briefs) shall be legible and in a form suitable for reproduction, filing, and retrieval. Documentation must be sufficient to permit technically qualified individuals to review and understand the calculation and verify the results.

In addition to the arithmetic calculation, calculation briefs shall also include backup and discussion in sufficient detail to adequately present supporting information and data. Calculations should be performed in pencil and shall include the following

- Date
- Name of person performing calculation
- Statement of calculation intent
- Modeling requirements, if applicable
- Description of methodology
- Assumptions and their justifications
- Input data and equation references
- Numerical calculations, including units
- Results.

Calculations shall be verified following these specific checkprinting procedures

- The Project Manager assigns checking responsibility to a qualified person.

- The originator supplies the designated checker with a photocopy of the calculation package (calculation brief). Originals should not leave the originator's possession until they are ready for final signing by the checker.

- The checker marks (highlights) each item, line-by-line on the calculation copy, with a yellow marker for all items with which the checker approves or agrees.

- If the checker disagrees, for any reason, the checker crosses through the item with a red pen and writes the recommended correction or comment above it.

- The checker signs and dates all pages of the checkprints.

- The checker returns the checkprints to the originator who, in turn, reviews all recommended changes. If a disagreement still exists, the originator adds comments to the checkprints using a third color, initials and dates the changes, and then confers with the checker until all differences are resolved (the Project Manager or Program Manager may act as mediator and final authority, if necessary).

- The originator corrects the calculation originals so they agree with the checkprints. A one-to-one correspondence between the originals and checkprints must exist.

- The originator gives the originals and checkprints to the checker who compares them to verify agreed-to corrections have been made.

- When the checker is satisfied that there is a one-to-one correspondence between checkprints and originals and that the calculation brief satisfies the calculation intent, the checker signs and dates the originals.

8.3 Data Validation

Data validation shall be performed systematically to review data for acceptable data quality (DOE, 1991) and shall be reviewed against a set of criteria to provide assurance that the data are adequate for their intended use. Data validation consists of data editing, screening, checking, auditing, verification, and review (EPA, 1983). Validation must be performed by an individual(s) other than the person(s) who performed the original work or specified the method.

Analytical validation procedures for the various analytical levels and parameters shall follow the guidelines of the EG&G Rocky Flats, General Radiochemistry and Routine Analytical Services Protocol (GRRASP, 1991)

The field data validation shall include, but will not be limited to, the following data

- Resumes of the field team to ensure that they are qualified to conduct the sampling
- Results of the field audits or surveillances
- Completeness of the field documentation
- Compliance with SOPs that relate to field sampling
- Verification of the field results recorded in the logbook with the final laboratory reported results.

8.4 Data Reporting

The laboratory data shall be reported in picocuries per gram (pCi/g) for solids or picocuries per liter (pCi/l) for liquids for radiological parameters and micrograms per kilogram (μg/kg) for nonradiological parameters of the waste characterization analyses. Data must be provided in a format easily associated with support documentation, which must be provided with the report. Support documentation shall include QC data and must be sufficient for the independent data validation process.

Validation data packages shall include information listed on EG&G GRRASP document completeness checklists appropriate for each parameter.

9.0 Internal Quality Control Checks

Field sampling and laboratory analytical activities shall include the introduction of QC samples. These samples shall be introduced into the analytical stream in order to assess the overall data quality developed by the program. The samples will be used to evaluate sampling and analytical accuracy and precision, and levels of potential contamination introduced by the sampling and analytical effort. The QC samples that will be utilized are described below.

9.1 Quality Control Samples

QC samples for the Project Chariot: 1962 Tracer Study site assessment and remediation shall include field and laboratory duplicates and blanks, and laboratory spikes. Field QC samples (blanks and duplicates) will provide an estimate of the error or uncertainty associated with a sampling and analysis effort. Laboratory blanks, spikes, and duplicates will provide estimates of the error or uncertainty of the analytical activities.

The following list summarizes each type of QC sample and its quality function.

- Duplicate: Duplicate samples are multiple samples collected at the same location, at the same time, using the same sampling technique. Analyses of duplicate samples provide information to evaluate the precision of an analytical process and the consistency of the sample collection activities. Wide variation in duplicate results indicates a need for review of analytical and sampling activities.

- Field Blank: A field blank is a volume/weight of water or solid that is provided by the sample collectors to determine the presence of any contamination introduced during sampling. Deionized, distilled laboratory water for liquid samples or a purified solid matrix for soil/sediment samples will be placed into sample containers by the samplers. Depending on the nature and extent of the contamination, the samples may be corrected for the field blank concentration or the sources resampled. Possible contamination sources to be checked, include sample containers, sample storage facilities, field handling procedures, and sampling tools. Results will be maintained with the corresponding sample and analytical data in the laboratory project records file.

- Matrix Spike: A matrix spike is a separate sample aliquot spiked by the laboratory with the analyte of interest to evaluate the effect of the sample matrix on the analytical method's accuracy. The results should be summarized on quality control data summary sheets for the parameter of interest. Internal spikes of an isotope similar in characteristics to the isotope of interest may be used in lieu of matrix spikes if used in each sample.

- Method Blank: A method blank is a volume of deionized, distilled water processed by the same method as the samples with all reagents added. Elevated results of blanks indicate contamination introduced within the laboratory from cross-contamination or from reagents introduced during the process. Results will be maintained with the corresponding sample analytical data in laboratory project files.

- Laboratory Control Sample (LCS): An LCS is a spiked blank matrix sample that is carried through the entire sample preparation and analysis method. Recovery criteria must be met for the analytical results of the batch to be acceptable.

- Split-Sample: A split sample is a sample divided into multiple portions, with each portion sent to a different organization or laboratory. Samples should be subjected to the same or similar environmental conditions and steps in the testing process. Splits may be performed in the field or in the laboratory. A field split sample provides precision information about all activities after sample acquisition, including effects of storage, shipment, analysis, and data processing; whereas, information on interlaboratory precision of sample preparation and analysis is provided by samples split just after they are received at the laboratory.

- Surrogate Standards: Surrogate standards are nontarget compounds added to Gas Chromatograph (GC) and Gas Chromatograph/Mass Spectrometer (GC/MS) standards, blanks, and samples prior to extraction or purging, used to monitor the percent recovery efficiencies of the sample preparation and analytical procedure on a sample-by-sample basis.

  Volatile organic samples will be spiked with
  - 4-bromofluorobenzene (BFB)
  - 1,2-dichloroethane-d4
  - Toluene-d8

  Semivolatile organic samples will be spiked with
  - 2-fluorobiphenyl
  - 2-fluorophenol
  - Nitrobenzene-d5
  - Phenol-d5
  - Terphenyl-d14
  - 2,4,6-tribromophenol.

  Decachlorobiphenyl shall be used as the primary surrogate for PCB analysis. Tetrachlorometaxylene (TCMX) may be used as an alternate.

- Trip Blank: Total organic samples are susceptible to contamination by diffusion of organic contaminants into the sample container. Therefore, trip blanks shall accompany sample containers during shipment and storage to monitor for possible contamination. The trip blanks shall consist of two 40-mℓ vials filled with organic free material for each batch of sample containers and sample shipments.

As part of the analytical QC testing program, the laboratory shall use quality control sample results to assess precision and accuracy criteria for each parameter that is analyzed. When the analysis of a sample set is completed, the quality control data generated must be evaluated based on set criteria. The following criteria shall be used

- Duplicate Sample Evaluation: During sample analysis duplicates shall be used to determine the precision of the analytical method for the sample matrix. The duplicate results shall be used to calculate the precision as defined by the Relative Percent Difference (RPD), where:

$$RPD = \frac{A - B}{\left(\frac{A + B}{2}\right)} \times 100$$

A = Original Sample Result
B = Duplicate Sample Result

For analytical methods that do not have established control limits for precision, RPD may be plotted on control charts for each parameter of interest. If the precision value exceeds the warning limit for the given parameter, the Quality Control Coordinator must be notified. If the precision value exceeds the control limit, the reason for the nonconformance must be determined.

- Field or Trip Blank Evaluation: Field blank results shall be evaluated for high readings similar to the method blanks. If high blank readings are encountered (i.e., a value sufficient to result in a difference in the sample values, if not corrected, greater than or equal to the smallest significant digit), the procedure for sample collection, shipment, and laboratory analysis shall be reviewed. If the method blanks and the field blanks exhibit significant background readings, the source of contamination is probably within the laboratory. Sample containers or sample leakage could also be a source of high field blank readings.

- Matrix Spike Evaluation: The observed recovery of the spike versus the known concentration of the spike shall be used to calculate accuracy as defined by the %R, where

$$\%R = \frac{Oi - Os}{Ki} \times 100$$

Oi = Observed Spiked Sample Concentration
Os = Sample Concentration
Ki = Known Concentration of Spike

The accuracy value, %R, shall be plotted on control charts for each parameter of interest. If the accuracy value exceeds the warning limit for the given parameter, the Quality Control Coordinator must be notified. If the accuracy value exceeds the control limits, the reason for the nonconformance must be determined.

- Method Blank Evaluation: The method blank results shall be evaluated for high readings characteristic of background constituents. If high blank values are observed, laboratory glassware and reagents should be checked for the constituent and the analysis of future samples halted until the system can be brought under control. A high background is defined as a background value sufficient to result in a difference in the sample values, if not corrected, greater than or equal to the smallest significant digit.

- Surrogate Standard Evaluation: The surrogate standard results shall be compared with the true values of the spike and the %R of the analysis determined as an accuracy value. This value must meet acceptance limits set and shall be evaluated in accordance with the analytical procedures.

9.2 Field Quality Control Samples

The minimum frequency for field QC samples shall be one per sample batch or one for every 20 samples, whichever is greater, for each sampling activity listed by the sample type below

Field Duplicates

- Waste characterization
- Water sampling
- Sediment sampling
- Soil sampling
- Background soil sampling
- Biological sampling.

Trip Blanks

- Waste characterization.

Field Blanks

- Waste characterization
- Water sampling
- Sediment sampling
- Soil sampling
- Background soil sampling.

9.3 Laboratory Quality Control Samples

9.3.1 On-Site Laboratory

The on-site lab shall perform only one analysis, gamma spectroscopy, which requires only physical preparation of the sample and direct counting. Therefore, the QC checks required shall be limited to verifying the accuracy and precision of the counting system. A mixed gamma calibration standard shall be counted daily prior to counting samples. A Cesium-137 QC sample, approximately twice the activity of the action level, shall be counted between samples to verify that the instrument remains in control for the primary constituent during the shift. One in 20 samples shall be counted twice to provided additional precision data.

9.3.2 Off-Site Laboratory

The minimum frequency for laboratory QC samples shall be one per sample batch or one for every 20 samples, whichever is greater, for each analyte. The laboratory QC samples associated with each type of analyses required for this project are as follows

Radiological Parameters

- Laboratory duplicate
- Method blank
- Matrix spike or internal tracer or LCS.

Organic Waste Characterization Parameters

- Matrix spike and matrix spike duplicate (per sample delivery group)
- Surrogate standard
- Method blank
- Laboratory duplicate.

Nonorganic Waste Characterization Parameters

- Laboratory control sample
- Matrix spike
- Method blank
- Laboratory duplicate.

As part of the analytical quality control testing program, the laboratory shall use QC sample results to determine accuracy and precision for each parameter analyzed. The QC data generated shall be evaluated based on set criteria as defined in the laboratory QA/QC manual.

10.0 Performance Assessment

To verify compliance with specific project requirements, QA and project management shall perform assessments of work activities, which will consist of an evaluation of procedures, the effectiveness of their implementation, and a review of activity documentation.

10.1 Field Operations Assessments

The DOE and IT Project Managers shall conduct reviews and assessments of field activities to verify proper implementation of work plans and procedures. These assessments shall be documented in memos or surveillance reports and copies submitted to the project files.

The QAO assigned to the project shall perform surveillances of project activities to verify compliance with approved project document requirements. Items to be examined shall include the availability and implementation of approved work instructions; calibration, maintenance, and operation of equipment; sampling, sample preparation, labeling, packaging, storage, and shipping of samples and derived waste; performance documentation and checking; and change/nonconformance documentation. Surveillances performed by the QAO shall be documented in accordance with the IT procedure ITLV-0203, "Surveillances." The responsible management shall be briefed upon completion of the assessment so any required corrective action can be initiated immediately. Due to constraints of the project, handwritten reports shall be acceptable and shall be filed in the on-site project files.

10.2 Performance Samples

The off-site laboratory shall be required to participate in analysis of performance evaluation samples in the DOE Environmental Intercomparison Program and EPA Laboratory Intercomparison Program. Analysis results shall be compared to predetermined or calculated acceptance limits. Records of performance evaluation samples shall be maintained, and any problems shall be identified, corrective actions taken, and performance reevaluated prior to analysis of additional applicable samples.

11.0 Preventive Maintenance and Schedules

Preventive maintenance schedules must be implemented for both field and analytical equipment that is critical to the timely completion of the project.

Instrument manuals shall be referenced when equipment requires maintenance. Any equipment that fails calibration or becomes inoperable during use shall be removed from service, tagged, and segregated to indicate that it cannot be used; this equipment shall be repaired and recalibrated prior to further use. Records and results of maintenance and calibration shall be kept for each instrument. Records shall be maintained by the field office or laboratory that controls the equipment.

11.1 Field Equipment Preventive Maintenance

Preventive maintenance is the responsibility of project personnel and shall be performed on all field equipment prior to use, as required. Each piece of equipment must be checked for proper operation and results of checks documented on FADLs. If equipment is battery-operated, battery checks must be performed regularly. Appropriate and sufficient replacement parts or back-up equipment shall be available so that sampling tasks are not substantially impeded or delayed.

11.2 Analytical Laboratory Equipment Preventive Maintenance

Analytical laboratory equipment preventive maintenance shall be the responsibility of the laboratory. At a minimum, the laboratory must have

- Service contracts on all major instruments
- Spare parts as recommended by the instrument manufacturer
- The above items delineated in the laboratory's written QA/QC plan.

12.0 Specific Routine Procedures to be Used to Assess Data Precision, Accuracy, and Completeness

Procedures described in this QAPjP shall be strictly followed to maintain a high standard of data precision, accuracy, and quality within the field.

Methods, such as duplicates and performance samples, must be used to evaluate off-site laboratory performance. Comparing the concentrations of the various constituents between duplicate analyses will indicate the analytical precision. Analytical accuracy shall be checked by introducing known standard solutions at the laboratory for analysis. Accuracy may then be determined by comparing analytical results with the accepted true value. Accuracy of the control samples must be within the accepted accuracy of the method of analysis for the analyte of interest (see Table 3-1). Those spikes or audit samples falling outside this range shall be brought to the attention of the Laboratory Director for corrective action. Similar actions must be taken for duplicates used to establish precision. Completeness shall be determined by comparison of the number of samples expected to be collected compared with those samples for which acceptable analytical results are received. An objective of 80 percent completeness or greater is set.

Laboratory results shall be checked immediately upon receipt. If there appears to be an error in the analyses, the laboratory shall be contacted immediately, and corrective action must be taken. If the error is typographical, it shall be corrected; if the error is analytical, the analysis must be conducted again. If investigation reveals that processes were not in control, corrective action shall be taken as outlined in Section 13.

13.0 Corrective Action

The Project Chariot Site Assessment and Remedial Action Project will have several types of sampling activities with uncertainties in each area. The on-site laboratory presents many uncertainties, as well. Proper control of any needed changes or any nonconformances is essential to the success of the project. Deviations may take the form of a technical variance or a nonconformance.

13.1 Change Control

A project change (or variance) is required when original plans must be altered due to events that occur during the work performance. All changes to the sampling program activities or the laboratory procedures shall be carefully controlled and documented. Any changes to the scope of work that vary from the original SAP must be approved by the DOE and IT Project Managers and the QAO. These changes shall be documented in a variance log (Figure 13-1) or a procedure change notice as stipulated in the IT Las Vegas Standard Quality Practice ITLV-0100. Any changes to the off-site laboratory analytical scope must also be approved by the Laboratory Director. All change approvals shall be documented and documentation maintained in the project files.

13.2 Nonconformances/Corrective Action Control

Nonconformances differ from changes in that they are unapproved deviations from the project's written approved plans or procedures, the QAPjP, or the client requirements. A nonconformance may be detected by program or project personnel, laboratory personnel, QA personnel, subcontractor personnel, or outside auditors. Each nonconformance shall be documented by the individual identifying the item or action as nonconforming. Depending upon who identifies the occurrence, where the nonconformance occurs, and the nature of the nonconformance, it may be documented on nonconformance report forms, audit reports, inspection reports, or a Notice of Equipment Failure.

Nonconformances identified by project field personnel shall be documented on an NCR form (Figure 13-2) and submitted to the QAO with a copy to the IT Project Manager. The signature of the QAO and the IT Project Manager must be included on a nonconformance report.

INTERNATIONAL TECHNOLOGY CORPORATION

VARIANCE NO.: ____________

VARIANCE LOG

PROJECT NO.: ______________ PAGE ____ OF ______

PROJECT NAME: ________________________________ DATE: __________

VARIANCE (Include Justification):

APPLICABLE DOCUMENT:

REQUESTED BY: ________________________ Date: ________

Approved By: ________________________ Date: ________
Project Manager

________________________ Date: ________
Quality Assurance Officer

________________________ Date: ________

Figure 13-1
Variance Log

NONCONFORMANCE REPORT

Project/Job No. ______________________________ Page____ of____

Project/Job Name ______________________________ Date __________

Phase/Task ________________________

Nonconformance:

Identified By: ________________________________ Date:________

Corrective Action Required:

To Be Performed By: ______________________________ Date:_______

Must Correction Be Verified? Yes____ No_____

To Be Verified By: ________________________________

Prepared By: ______________________________________ Date:_______

Corrective Action Taken:

Performed By: ____________________________________ Date:_______

Verified By: _____________________________________ Date:_______

CC: Approved By: ________________________ Date: _______

________________________ Date: _______

Figure 13-2
Example of Nonconformance Report Form

NONCONFORMANCE REPORT LOG

NCR NUMBER	PROJECT NUMBER	DATE ISSUED	RESPONSIBLE MANAGER	CORRECTIVE ACTION TARGET DATE	VERIFIED DATE/ INITIALS

Figure 13-3
Example of Nonconformance Report Log

Upon identification of an NCR, the IT Project Manager shall verbally notify the DOE Project Manager and shall provide a written report as soon as it is completed. The QAO shall maintain a log (see Figure 13-3) of all project NCRs and verify completion of corrective actions. If a corrective action cannot be completed by the target date, the IT Project Manager shall request an extension from the QAO. This request shall include justification for the requested extension. In the absence of an approved extension, if a corrective action target date is missed, the QAO shall notify the IT Project Manager. In the event of continued non-responsiveness, the QAO shall notify the next higher level of management.

Laboratory nonconformances shall be documented per the laboratory QA manual requirements using approved forms. Lab NCRs shall be submitted to the Laboratory Quality Control Coordinator, who shall maintain an NCR log. NCRs occurring in the laboratory must be reported to the IT Project Manager and the QAO by the Laboratory Director.

It is the responsibility of the IT Project Manager and the QAO to notify appropriate project personnel of significant nonconformances. Work shall not proceed on nonconforming items or activities until an approved disposition has been obtained and any required corrective actions completed. Reworked items must be reexamined in accordance with requirements that were applicable to the original item, unless otherwise indicated in the nonconformance report. If work on a nonconforming item or activity must continue prior to completion of required corrective action, an approved conditional release must first be obtained from the appropriate Project Manager or Laboratory Director. The request for conditional release must contain documented justification that the following conditions can be met

- The nonconforming item or activity can be corrected at a later date without adversely impacting the quality of the final work results.
- The nonconforming item or activity has been evaluated, and any resulting limitations for use of the item or activity results have been established and communicated to the appropriate personnel.
- Traceability of any nonconforming item can be maintained.

If, during the management evaluation of a nonconformance, it is determined that a significant condition adverse to quality exists, additional controls shall be implemented. Significant conditions adverse to quality are those that, if not corrected, would have a high probability of causing erroneous project results to be reported and could adversely affect decisions and conclusions based on those results. An example of significant conditions adverse to quality are conditions generic in nature to a large number of items or a deficiency in the quality program. Such nonconformances shall require the following actions

- The IT Project Manager shall verbally report the nonconformance to the DOE Project Manager immediately and in writing within five days.

- The adequacy of the Project Chariot Remedial Action Project requirements shall be reviewed for needed modifications to prevent recurrence of the nonconformance.

- Corrective actions shall be completed as soon as is practical after approval has been received.

- Completion of corrective actions shall be documented and verified by QA personnel in a timely manner.

The project QAO shall review NCRs for recurring nonconformances. Such incidents shall be reviewed by the Project Manager and the QAO to determine the root cause and if changes should be instituted in the program or project requirements to prevent recurrence.

14.0 Quality Assurance Reports to Management

The IT QAO shall provide a report to the IT and DOE/NV Project Managers at the conclusion of the project. The report shall include

- An assessment of analytical and field measurement data accuracy, precision, and completeness
- Results of audits and surveillances
- A discussion of significant QA problems and corrective actions taken
- Lessons learned.

Copies of all surveillance reports shall be provided to the IT Project Manager and the IT Program Manager.

15.0 Procurement/Items Control

Items and services of a technical nature provided to the Project Chariot Site must be of a quality compatible with the quality-related requirements of the project. Controls shall be established to ensure that correct equipment and services are purchased and that systems are in place to track items and confirm the delivery of procured items and services.

15.1 Procurement

Procurement documents of technical equipment/supplies shall include the following to ensure acceptable and correct purchases.

- Detailed specifications of the item or service, including quantities, units of measure, part numbers/descriptions, and price
- Authorized signatures, including the QAO's
- Vendor information, including quote or bid evaluation
- Shipping terms
- Verification of receipt and acceptability.

Any subcontractors used on this project shall be prequalified by IT's subcontractor prequalification process. Only contractors who have a record of good safety performance, adequate insurance coverage, and effective quality practices will be hired. The IT QA Manual's Standard Quality Practice, ITC005, "Subcontractor Prequalification," shall be used for this procedure.

16.0 Project Readiness

16.1 Readiness Reviews

Project readiness shall be assessed at two stages: prior to initial mobilization and again prior to mobilization from the Alaskan staging area to the project site. A project kick-off meeting will be held in Las Vegas, Nevada, with DOE and IT Project personnel. Project documents shall be reviewed, and lines of communications between the organizations and organizational authority and responsibilities shall be confirmed.

Readiness criteria for stage one shall include the following

- Work instructions are adequate and appropriate, and have been formally approved.
- Personnel, equipment, and material resources required are contracted and scheduled.
- Assigned personnel have read project work instructions applicable to their work and have been suitably trained and qualified, and documentation is available in project files.
- All personnel training and medical monitoring records have been submitted to the Project Health and Safety Manager, reviewed/approved, and transferred to the site project file.
- Internal and external interfaces have been defined.
- Proper work authorizations and work permits have been obtained.
- All test and measurement equipment has been recently calibrated.

A project kick-off meeting will also be held in Alaska, with all ADEC representatives, subcontractor personnel, and other area participants not present for the Nevada meeting, to cover the Project Health and Safety Plan requirements.

Readiness review requirements for stage two include

- Copies of the Site Assessment and Remedial Action Plan, Health and Safety Plan, Sampling and Analysis Plan, Quality Assurance Project Plan, and Standard Operating Procedures are available for personnel use onsite.
- The Site Assessment and Remedial Action Plan checklist for equipment and materials has been completed.

The IT Project Manager shall assure the completion of all Site Assessment and Remedial Action Plan checklists prior to mobilization to the site. Checklists and reviews must be documented and submitted to project files.

16.2 Personnel Qualification and Training

Project activities shall be performed by personnel qualified on the basis of education, experience, and training. Personnel qualifications shall be evaluated on objective evidence, based on the assigned responsibilities and training needs identified. Documentation shall include resumes, training records, and certifications and shall be maintained in the project files.

Training shall be provided on project-specific requirements and shall be documented on a standard form (Figure 5-1). Project-specific training shall include orientation to the Sampling and Analysis Plan, the Health and Safety Plan, and the Quality Assurance Project Plan as appropriate for assigned duties.

The off-site laboratory training requirements shall be specified in the laboratory QA manual, and documentation shall be maintained by the laboratory. Training on project requirements shall be conducted and documented.

17.0 References

EG&G Rocky Flats, 1991, *General Radiochemistry and Routine Analytical Services Protocol (GRRASP)*, Golden, Colorado.

U.S. Department of Energy, 1991, *Quality Assurance*, DOE Order 5700.6C, U.S. Department of Energy, Office of Nuclear Energy/Office of Environment, Safety, and Health, August 1991.

U.S. Environmental Protection Agency (EPA), 1978, *NEIC Policies and Procedures Manual*, Office of Enforcement, EPA-330-9-78-001, May 1978.

U.S. Environmental Protection Agency, 1983, *Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans*, QAMS 005/80, Office of Exploratory Research, Washington, D.C., February 1983.

U.S. Environmental Protection Agency, 1988a, *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA, Interim Final*, EPA/540/G-89/004, October 1988.

IT Corporation, 1992, Environmental Support Services for DOE/NV Environmental Restoration Program, *IT Quality Assurance Program Plan*, Las Vegas, Nevada.

IT Corporation, 1992, EES Division, *IT Quality Assurance Manual, Vol I & II.*

U.S. Environmental Protection Agency, 1987, *Data Quality Objectives for Remedial Response Activities, Development Process*, Office of Solid Waste and Emergency Response, Washington, D.C.

SAMPLING AND ANALYSIS PLAN

PART III

STANDARD OPERATING PROCEDURES

This page intentionally left blank

INTERNATIONAL
TECHNOLOGY
CORPORATION

ITLV

STANDARD OPERATING PROCEDURE

NUMBER: CHR-01

TITLE: **Sample Control and Documentation**

APPROVED: ______________________ **DATE:** 7/9/93
ITLV Program Manager

APPROVED: ______________________ **DATE:** 7-9-93
ITLV Project Manager

APPROVED: ______________________ **DATE:** 7/9/93
ITLV Quality Assurance Officer

CONTROLLED COPY NO. : _____

REVISION NO.	**DATE**

TABLE OF CONTENTS

1.0 SCOPE AND OBJECTIVE

1.1 Scope - This SOP describes the procedures to be used for sample control and documentation from preparation stages through shipment of samples. Directions for sample screening, packaging and shipping are provided in related SOPs.

1.2 Objective - The objectives of this procedure are to plan and document sampling activities such that the integrity of the sample is protected, that resulting data are defensible, and that the quality of the sampling activities can be verified.

2.0 DEFINITIONS

2.1 Chain-of-Custody/Request for Analysis (COC/RFA) Form - A printed form that accompanies a sample or group of samples as custody of the sample(s) is transferred from one custodian to the subsequent custodian. One copy of the form must be retained in the project file. The record also provides the type of analysis which is to be performed on the sample(s).

2.2 Carrier - A person or firm engaged in the transportation of passengers or property.

2.3 Custodian - The person responsible for the custody of samples at a particular time, until custody is transferred to another person (and so documented), who then becomes custodian. A sample is considered in your custody if it:

- Is in your actual possession
- Is in your view, after being in your physical possession
- Was in your physical possession but is now in a secured area to prevent tampering
- Is in a designated secured area, restricted to authorized personnel only.

2.4 May - The word may is used to denote permissibility.

2.5 Sample - A sample is physical representative evidence collected from a facility or the environment, that is representative of certain conditions at the point and time that it was collected.

2.6 Shall - The word shall denotes a requirement.

2.7 Should - The word should is used when an element is recommended.

3.0 RESPONSIBILITIES AND QUALIFICATIONS

3.1 IT Project Manager - The IT Project Manager is responsible for assuring the implementation of this procedure during the performance of project activities.

3.2 Sampling and Analysis Supervisor (SAS) - The SAS is responsible for the implementation of this procedure. The SAS shall select qualified personnel to perform this activity.

3.3 Quality Assurance Officer - The Quality Assurance Officer is responsible for approving this procedure and performing surveillances to verify compliance with this procedure.

3.4 Field Personnel - Field personnel are responsible for meeting the requirements of this procedure and for the Site-Specific Health and Safety Plan (SSHASP).

4.0 MATERIALS/EQUIPMENT AND CALIBRATION REQUIRED

The following materials are required for this procedure:

- Field forms as listed in Section 7.0
- Insulated coolers
- Ballpoint pen (permanent ink)
- Felt-tip marker pen (permanent black ink)
- Wide-mouth polyethylene containers (0.5, 1, and 2 liters)
- IT custody tape.

5.0 METHOD

5.1 Preparation

5.1.1 Office

5.1.1.1 Review the related SOPs listed in Section 8.2 and the SSHASP.

5.1.1.2 Coordinate schedules/actions with the field staff.

5.1.1.3 Assemble the equipment and supplies listed in Section 4.0.

5.1.1.4 Notify the analytical laboratory of sample types, the number of samples, and the approximate arrival date. Request sample containers based on sample types, and analytical parameters.

5.1.1.5 For shipping instructions see SOP-CHR-09, Shipment of Samples.

5.1.2 Documentation

5.1.2.1 Record results of the equipment checks in the log appropriate for types of equipment to be used.

5.1.2.2 Obtain a sufficient number of the appropriate data collection forms (e.g., Sample Collection Logs, and COC/RFA Forms) to record data for the length of time field activities are scheduled, plus a contingency supply.

5.1.2.3 Obtain certificates of bottle cleanliness for chemical analyses sample containers, as appropriate.

5.1.3 Field

5.1.3.1 Organize sample containers, sample labels, and documentation in an orderly, systematic manner that promotes consistency and accountability of all data.

Complete appropriate items before samples are collected (project information may be entered during advance preparation).

5.1.3.2 Record all pertinent information (date, site name, ID number, and location) on the Field Activity Daily Log (FADL) and the appropriate data forms. Note field conditions, unusual circumstances, weather conditions.

5.1.3.3 Fill out information on the sample identification label and attach the label to the appropriate sample container.

5.1.3.4 Complete initial information required on data collection forms.

5.2 Operation

5.2.1 Field Activity Daily Log

5.2.1.1 Enter all information pertinent to a field activity on a FADL or Logbook with consecutively numbered pages. A standard IT FADL is provided in Attachment A. The following information should be included in the FADL:

- Date.
- Purpose of sampling.
- Name and affiliation of field personnel and visitors to the site.
- Site identification.

- Any uncompleted work.

- A general description of the day's field activities showing the chronological sequence of events. It is preferable to use the 24-hour time notation (e.g., 9:00 am is 0900 and 5:00 pm is 1700).

- Documentation of weather conditions and any significant changes during the day.

- Field equipment calibration data and identification of the standard(s). Alternatively, this data may be recorded on a Calibration Log with a reference to the log placed in the FADL.

- Field measurements such as temperature, approximate wind speed and direction, and readings from personnel safety instruments and monitoring equipment. Measurements should always include units.

- References to appropriate field data forms for details of each sampling activity performed.

- Field equipment identification such as type, manufacturer, serial number, and model number.

Each page must be signed and dated by the person preparing the record. The form must be completed with no blanks left on the form. Not applicable (NA) shall be entered where information requested is not applicable to the site or work being performed.

5.2.1.2 Because sampling situations vary widely, make notes as descriptive and inclusive as possible. A person reading the entries should be able to reconstruct the sampling situation from the recorded information. Use language that is objective, factual, and free of personal feelings or any other inappropriate terminology.

5.2.1.3 If anyone other than the person to whom the FADL was assigned makes an entry, he/she should date and sign the entry. If a mistake is made, draw a single line through the mistake, write the new information above the line, and date and initial the change.

5.2.2 Sample Collection Log - Sample Collection Logs shall be completed as samples are collected. Information to be recorded on this form includes:

- Unique sample identification number.
- Amount of sample collected.
- Description of sampling point(s).
- Date and time for collection of sample.
- Collector's name(s).
- References to the sampling site (i.e., sketch and base map location or photographs).
- Field observations and sampling locations.
- Associated field measurements.
- Method of sample collection, preservation techniques, and any deviations or anomalies noted.
- Any uncompleted work.

Attachment B provides an example of a Sample Collection Log.

5.2.3 Sample Labels

5.2.3.1 Whenever possible, prepare sample labels and affix to sample containers prior to field activities. Attachment C provides an example of the standard sample label to be used and instructions for completing the labels. All label information may be completed during advance preparation except collection date and time and collector's name.

5.2.3.2 After collecting sample, wipe off the exterior of the sample containers to remove any moisture/soil. Add collection date and time and collector's name. After assuring that all label information is correct and complete, cover label with clear strapping tape to protect label.

5.2.3.3 If for any reason labelling of containers must be performed in the field, affix completed label to the container after it has been thoroughly cleaned and dried.

5.2.4 Chain-of-Custody/Request for Analysis Form

5.2.4.1 Use the COC/RFA Form to create an accurate written record that can be used to trace the possession and handling of the sample from the moment of its collection through analysis and introduction as evidence. A copy of the standard IT form is provided in Attachment D.

5.2.4.2 When transferring samples, the person relinquishing the samples shall sign and record the date and time on the COC/RFA Form in the first open space for "Relinquished by." Custody transfers made to a sample custodian in the field shall account for each sample listed on the form. The person accepting custody of the samples shall sign and record the date and time in the space labeled "Received by" that corresponds to the space signed by the relinquishing custodian. Detailed instructions are provided in Attachment D.

5.2.4.3 The Sampling and Analysis Supervisor is responsible for proper packaging and dispatch of the sample(s) to the appropriate laboratory. This responsibility includes filling out, dating, and signing the appropriate portion of the COC/RFA Form.

5.2.4.4 Send all packages to the laboratory with the COC/RFA Form and other pertinent information such as radioactive screening results. Retain a copy of these documents at the project site as well as the airbill or bill of lading. For packages sent by common carrier, retain receipts as part of the permanent chain-of-custody documentation.

5.2.4.5 Pack samples so that they will not break in shipment. Seal and, if possible, lock the package so that any tampering can be readily detected. SOP-CHR-09, Shipment of Samples, describes these procedures in detail.

5.3 Post Operation

5.3.1 Field

5.3.1.1 Verify that all sample containers have been correctly identified, labeled, and have all necessary information (location, time, date, etc.)

5.3.1.2 Cross-check filled sample containers in possession against those recorded on the Sample Collection Logs. Maintain custody of filled sample bottles by keeping them in actual possession, within view, locked or sealed to prevent tampering, or store them in a secure area restricted to authorized personnel.

5.3.1.3 Prepare the samples for transport according to this SOP and SOP-CHR-09, Shipment of Samples.

5.3.1.4 Complete FADL entries, verify the accuracy of entries, and sign and date all pages.

5.3.1.5 Verify completeness of COC/RFA Form.

5.3.1.6 Review data collection forms for completeness.

5.3.2 Field Office

5.3.2.1 Deliver original forms and FADLs to the IT Project Manager or Site Supervisor for technical review.

5.3.2.2 Contact the analytical laboratory to ensure that samples arrived safely and instructions for sample analyses are clearly understood. If needed, request additional sample containers from the lab.

6.0 REQUIRED INSPECTION/ACCEPTANCE CRITERIA

Sample containers must be inspected upon receipt from the lab to verify the correct number and type of containers were received and that all are undamaged.

7.0 RECORDS

The following records, generated as a result of implementation of this procedure, shall be retained as quality records in accordance with DOE Order 1324.2A, Record Disposition and IT QA Program requirements.

7.1 Field Activity Daily Log

7.2 Sample Collection Log

7.3 Chain-of-Custody/Request for Analysis Record Form

7.4 Bottle Certification Forms (as appropriate)

8.0 REFERENCES

8.1 Requirements and Specifications

None

8.2 Related Procedures

8.2.1 SOP-CHR-02, General Field Instructions

8.2.2 SOP-CHR-04, Field Decontamination

8.2.3 SOP-CHR-05, Shipment of Remedial-Action-Derived Waste

8.2.4 SOP-CHR-06, Field Activity Photographs

8.2.5 SOP-CHR-07, Sediment Sampling

8.2.6 SOP-CHR-08, Surface Water Sampling

8.2.7 SOP-CHR-09, Shipment of Samples

8.2.8 SOP-CHR-10, Surface Soil Sampling

8.3 Other

None

9.0 ATTACHMENTS

9.1 Attachment A - Field Activity Daily Log

9.2 Attachment B - Sample Collection Log

9.3 Attachment C - Sample Identification Label and Instructions for Completing Label

9.4 Attachment D - Chain-of-Custody/Request for Analysis Form and Instructions for Completing Form

ATTACHMENT A

FIELD ACTIVITY DAILY LOG
(Page 1 of 1)

INTERNATIONAL
TECHNOLOGY
CORPORATION

FIELD ACTIVITY DAILY LOG

DAILY LOG

DATE	
NO.	
SHEET	OF

PROJECT NAME	PROJECT NO
FIELD ACTIVITY SUBJECT	
DESCRIPTION OF DAILY ACTIVITIES AND EVENTS:	
VISITORS ON SITE:	CHANGES FROM PLANS AND SPECIFICATIONS, AND OTHER SPECIAL ORDERS AND IMPORTANT DECISIONS.
WEATHER CONDITIONS:	IMPORTANT TELEPHONE CALLS
IT PERSONNEL ON SITE:	
SIGNATURE	DATE:

327A-7-86

ATTACHMENT B

SAMPLE COLLECTION LOG
(Page 1 of 2)

INTERNATIONAL
TECHNOLOGY
CORPORATION

DATE	
TIME	
PAGE ____ OF ____	
PAGE	
PROJECT NO.	

SAMPLE COLLECTION LOG

PROJECT NAME ____________________

SAMPLE NO. ____________________

SAMPLE LOCATION ____________________

SAMPLE TYPE ____________________

COMPOSITE ____ YES ____ NO

COMPOSITE TYPE ____________________

DEPTH OF SAMPLE ____________________

WEATHER ____________________

CONTAINERS USED	AMOUNT COLLECTED

COMMENTS:

PREPARED BY: ____________________

ATTACHMENT B

SAMPLE COLLECTION LOG
(Page 2 of 2)

COMMENTS:
(Continued)

DATE	
TIME	
PAGE ____ OF ____	
PAGE	
PROJECT NO.	

PREPARED BY: ____________________

LEGEND

1 A SAMPLE COLLECTION LOG IS TO BE COMPLETED FOR EACH SAMPLE.

2 ALWAYS COMPLETE BOTH SIDES. IF SECOND SIDE IS NOT USED. DRAW A LINE THROUGH IT AND MARK N/A. FILL IN CONTROL BLOCK AND PREPARED BY.

3. ALL ENTRIES ON LOG ARE TO BE COMPLETED. IF NOT APPLICABLE MARK N/A.

4 DATE: USE MONTH/DAY/YEAR; I.E., 10/30/85

5. TIME: USE 24-HOUR CLOCK: I E., 1835 FOR 6:35 P M

6 PAGE: EACH SAMPLE TEAM SHOULD NUMBER PAGE _____ OF _____ FOR THE DAY'S ACTIVITIES FOR ALL SHEETS PREPARED ON A SINGLE DAY. I E., IF THERE ARE A TOTAL OF 24 PAGES (INCLUDING FRONT AND BACK) NUMBER 1 OF 24. 2 OF 24. ETC.

7 SAMPLE LOCATION: USE BORING OR MONITORING WELL NUMBER. GRID LOCATION (TRANSECT). SAMPLING STATION I D . OR COORDINATE TO PHYSICAL FEATURES WITH DISTANCES. INCLUDE SKETCH IN COMMENT SECTION IF NECESSARY

8 SAMPLE TYPE: USE THE FOLLOWING - SOIL. WATER (SURFACE OR GROUND): AIR (FILTERS. TUBES. AMBIENT. PERSONNEL); SLUDGE DRUM CONTENTS OIL. VEGETATION: WIPE. SEDIMENT

9 COMPOSITE TYPE: I.E., 24-HOUR. LIST SAMPLE NUMBERS IN COMPOSITE. SPATIAL COMPOSITE

10 DEPTH OF SAMPLE. GIVE UNITS. WRITE OUT UNITS SUCH AS INCHES. FEET DON'T USE ' OR "

11 WEATHER APPROXIMATE TEMPERATURE. SUN AND MOISTURE CONDITIONS

12 CONTAINERS USED LIST EACH CONTAINER TYPE AS NUMBER. VOLUME. MATERIAL (E G . 2 - IL GLASS. 4 - 40 ML GLASS VIAL. 1 - 400 ML PLASTIC. 1 - 3 INCH STEEL TUBE 1 - 8 OZ. GLASS JAR)

13. AMOUNT COLLECTED: VOLUME IN CONTAINERS (E.G. 1/2 FULL).

ATTACHMENT C

SAMPLE IDENTIFICATION LABEL AND INSTRUCTIONS FOR COMPLETING LABEL
(Page 1 of 2)

1. Project Name. Name of project used on project files.

2. Project Number. List complete number including phase, task, and subtask, if applicable.

3. Sample Number. Use unique sample number as instructed in project work plan.

4. Collection Date/Time. Date the sample was collected in the form MM-DD-YY (01/01/92) and time in format HHMM using 24-hour notation (0925).

5. Collector's Name. Name of person(s) collecting sample.

6. Sample Location. Site-specific, sampling location, name or number.

7. Sample Type/Depth/Description. State matrix; depth from surface, if applicable; and description of sample.

8. Analyze For. State analyses required.

9. Preservative. Give type of preservative used, if applicable, and pH (HNO_3 to $pH \leq 2$).

10. Bottle ___ of ___. Number consecutively the containers of same sample for the same analysis and state which number of total this one is numbered (1 of 6).

11. Filtered/Nonfiltered. Check one as applicable.

ATTACHMENT C

SAMPLE LABEL
(Page 2 of 2)

INTERNATIONAL
TECHNOLOGY
CORPORATION

F
H R

Project Name ______________________

Project No. ______________________

Sample No. ______________________

Collection Date/Time ______________________

Collector's Name ______________________

Sample Location ______________________

Sample Type/Depth/Description ______________________

Analyze For ____________ Preservative ____________

Bottle ________ of ________ ______Filtered ______ Nonfiltered

23-8-85

ATTACHMENT D

CHAIN-OF-CUSTODY/REQUEST FOR ANALYSIS FORM AND INSTRUCTIONS FOR COMPLETING FORM
(Page 1 of 4)

INTERNATIONAL TECHNOLOGY CORPORATION

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD*

Reference Document No. 404652
Page 1 of ____

Project Name/No. 1
Sample Team Members 2
Profit Center No. 3
Project Manager 4
Purchase Order No. 6
Required Report Date 11

Samples Shipment Date 7
Lab Destination 8
Lab Contact 9
Project Contact/Phone 12
Carrier/Waybill No. 13

Bill to: 5

Report to: 10

ONE CONTAINER PER LINE

Sample Number 14	Sample Description/Type 15	Date/Time Collected 16	Container Type 17	Sample Volume 18	Pre-servative 19	Requested Testing Program 20	Condition on Receipt 21	Disposal Record No. 22

Special Instructions: 23

Possible Hazard Identification: 24
Non-hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown ☐

Sample Disposal: 25
Return to Client ☐ Disposal by Lab ☐ Archive ____ (mos.)

Turnaround Time Required: 26
Normal ☐ Rush ☐

QC Level: 27
I. ☐ II ☐ III. ☐ Project Specific (specify):

1. Relinquished by 28 (Signature/Affiliation)	Date: Time:	1. Received by 28 (Signature/Affiliation)	Date: Time:
2. Relinquished by (Signature/Affiliation)	Date: Time:	2. Received by (Signature/Affiliation)	Date: Time:
3. Relinquished by (Signature/Affiliation)	Date: Time:	3. Received by (Signature/Affiliation)	Date: Time:

Comments: 29

White: To accompany samples
Yellow: Field copy
*See back of form for special instructions

MCA 3/15/91

ATTACHMENT D

CHAIN-OF-CUSTODY/REQUEST FOR ANALYSIS FORM AND INSTRUCTIONS FOR COMPLETING FORM

(Page 2 of 4)

INSTRUCTIONS FOR COMPLETING THIS FORM

1. **Project Name/Number:** Record the name of the project or client site location, and the billing number of the project (Example - 613215: XYZ Chemical Co. WA).
2. **Sample Team Members:** List the names of all the members of the team taking these samples, team leader's name first.
3. **Profit Center Number:** For intra company work, indicate the originating profit center number.
4. **Project Manager:** Record the project manager's name.
5. **Bill to:** Non-IT personnel should indicate the correct billing address and the person to whom the invoice should be sent. IT personnel and IT subcontractors should fill in IT office responsible for project accounting (if known).
6. **Purchase Order No.:** Non-IT personnel should use this space to record the purchase order number authorizing the analysis of these samples. IT personnel and IT subcontractors should leave this space blank if a project number has been given for billing.
7. **Samples Shipment Date:** Indicate the date these samples are shipped to the laboratory.
8. **Lab Destination:** Indicate the laboratory designated for sample shipment. Do not list more than one lab on this form. Be certain before sending samples that the laboratory you are designating is aware of the shipment and is capable of accepting these sample types and has available capacity.
9. **Lab Contact:** Give the name of the laboratory contact (typically the Lab Project Manager).
10. **Send Lab Report to:** Give the name, address and phone number of the person to receive the data report for these samples.
11. **Required Report Date :** Record the date which you and the laboratory contact have determined the results will be reported (include verbal or final report as appropriate).
12. **Project Contact/Phone:** Indicate the name of the project person to be contacted in case of any questions regarding these samples and the phone number where the contact may be reached the day the samples arrive in the laboratory.
13. **Carrier/Waybill Number:** If you are sending the samples by a commercial carrier such as Airborne or Federal Express, record the courier company name and the waybill or airbill number under which these samples will be shipped (Example - Fed-Ex #51363177).
14. **Sample Number:** List the complete, unique, identification number of each sample. These numbers must correspond with the identification numbers on the sample containers and the field sample collection document(s).
15. **Sample Description/Type:** Provide a short physical description of the sample and the sample type such as soil, sediment, sludge, water, wipe, air concentrated waste or bulk.
16. **Date/Time Collected:** Record date and exact time each sample was collected. Use a 24-hour clock: i.e., 1645 not 4:45 p.m.
17. **Container Type:** Indicate the volume, color and type of the sample container used (Example - 1 gallon amber glass, 1 liter clear plastic, 40 milliliter clear glass).
18. **Sample Volume:** Estimate the amount of sample in the container. For air samples, indicate the volume of air sampled.
19. **Preservation:** Indicate what type of preservative, if any, has been used for the samples (Examples - ice to 4 C nitric acid, hydrochloric acid).
20. **Requested Testing Program:** List the analyses to be performed on each sample by method number.
21. **Condition on Receipt:** Before a custody transfer, the intended recipient should verify all samples are present and in good condition. This column may be used by the recipient to record any abnormalities found at the time of the transfer (Examples - jar lid cracked, sample bottle leaking).
22. **Disposal Record No.:** Used by the laboratory to record requisite disposal information. Not used when samples are returned to client.
23. **Special Instructions:** Use this space to record any special instructions to the lab regarding the processing of these samples.
24. **Possible Hazard Identification:** Indicate all hazard classes associated with the sample(s).
25. **Sample Disposal:** Indicate how the samples should be disposed of following analysis. All samples are held six weeks and then disposed of unless other arrangements for storage have been previously requested. Lab will charge for packing, additional archiving and disposal.
26. **Turnaround Time Required:** Check "Normal" or "Rush" as determined by the Project Manager and the laboratory contact. Rush samples are subject to a surcharge.
27. **QC Level:** These are ITAS QC levels and should not be confused with USEPA Analytical Levels.

    Level I: ITAS standard practice. Use available analytical procedures. Fifteen percent quality control (QC) samples (blank/spike duplicate) for every 20 samples. QC samples may not be performed for a specific project but as part of compiled sets of samples. QC data not reported with analytical results. ITAS published rates apply to client samples tested.

    Level II: Use available analytical methods. Fifteen percent QC samples minimum (blank duplicate spike or duplicate spike) QC samples are project or client-specific. QC summary report include with analytical results. No raw data are included. Each QC sample billed as (an) analytical sample.

    Level III: Uses referenced regulatory procedures, and/or established verified procedures using confirmatory techniques. Method blank plus 20 percent or low QC summary minimum per each matrix. QC summary report supplied with supporting data. Where applicable, this is USEPA Contract Laboratory Program (CLP) package. Surcharge is added and or QC samples are billed at sample rates. Costs based on analytical program required.

Project-specific: Defined in QAPjP, Work Plan, or other specific plan or procedure. Project documentation must be submitted to the laboratory before beginning work. Project requirements for QC samples cannot be less than Level I.

28. **Signatures:** When releasing custody of these samples, use the "Relinquished By" space to sign your full legal name, company name, date and time of release. After verifying that all samples are present, the person receiving the samples must sign the "Received By" space to take custody of the samples.
29. **Comments:** Provide any additional explanatory information that may be required (Example - samples stored overnight in temperature controlled, secure refrigerator).

ATTACHMENT D

CHAIN-OF-CUSTODY/REQUEST FOR ANALYSIS FORM AND INSTRUCTIONS FOR COMPLETING FORM

(Page 3 of 4)

INTERNATIONAL TECHNOLOGY CORPORATION

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD (cont.)*

Reference Document No.[30] ________
Page____of ____

Project Name

Project No.

Samples Shipment Date

ONE CONTAINER PER LINE

Sample [14] Number	Sample [15] Description/Type	Date/Time [16] Collected	Container [17] Type	Sample [18] Volume	Pre-[19] servative	Requested Testing [20] Program	Condition on [21] Receipt	Disposal [22] Record No.

White: To accompany samples
Yellow: Field copy
*See back of form for special instructions

MCA 3/15/91

ATTACHMENT D

CHAIN-OF-CUSTODY/REQUEST FOR ANALYSIS FORM AND INSTRUCTIONS FOR COMPLETING FORM
(Page 4 of 4)

INSTRUCTIONS FOR COMPLETING THIS FORM

14. **Sample Number:** List the complete, unique, identification number of each sample. These numbers must correspond with the identification numbers on the sample containers and the field samples collection document(s).
15. **Sample Description/Type:** Provide a short physical description of the sample and the sample type such as soil, sediment, sludge, water, wipe, air, concentrated waste or bulk.
16. **Date/Time Collected:** Record date and exact time each sample was collected. Use a 24-hour clock; i.e., 1645 not 4:45 p.m.
17. **Container Type:** Indicate the volume, color and type of the sample container used (Example - 1 gallon amber glass, 1 liter clear plastic, 40 milliliter clear glass).
18. **Sample Volume:** Estimate the amount of sample in the container. For air samples, indicate the volume of air sampled.
19. **Preservation:** Indicate what type of preservative, if any, has been used for the samples (Examples - ice to 4°C nitric acid, hydrochloric acid)
20. **Requested Testing Program:** List the analyses to be performed on each sample by <u>method number</u>.
21. **Condition on Receipt:** Before a custody transfer, the intended recipient should verify all samples are present and in good condition. This column may be used by the recipient to record any abnormalities found at the time of the transfer (Examples - jar lid cracked, sample bottle leaking).
30. ***Reference Document No.*** *The document number appearing on page 1 <u>must</u> be recorded for each additional page.*

INTERNATIONAL
TECHNOLOGY
CORPORATION

ITLV

STANDARD OPERATING PROCEDURE

NUMBER: CHR-02

TITLE: **General Field Instructions**

APPROVED: Joseph G. Yeasted — ITLV Program Manager **DATE:** 7/9/93

APPROVED: Andrea M. Hoffmann — ITLV Project Manager **DATE:** 7-9-93

APPROVED: Cheryl D. Prince — ITLV Quality Assurance Officer **DATE:** 7/9/93

CONTROLLED COPY NO. : _____

REVISION NO.	**DATE**

TABLE OF CONTENTS

1.0 SCOPE AND OBJECTIVE

1.1 Scope - To provide field personnel with instructions regarding activities to be performed before, during, and after field investigations.

1.2 Objective - The collection and documentation of data should be performed as described in specific SOPs. These general instructions are intended to supplement the information supplied in all sections and appendices of the Site Assessment and Remedial Action Plan, associated SOPs and clarify the role of field personnel at this remedial action. These instructions will ensure that field personnel take the proper precautions to understand the site, the objectives and schedule for the field program, their authority, and their responsibilities.

2.0 DEFINITIONS

2.1 May - The word may is used to denote permissibility.

2.2 Shall - The word shall denotes a requirement.

2.3 Should - The word should is used when an element is recommended.

2.4 Standard Operating Procedure (SOP) - Defines a task or activity and describes the method by which the task or activity must be performed.

3.0 RESPONSIBILITIES AND QUALIFICATIONS

3.1 IT Project Manager - The IT Project Manager is responsible for assuring the implementation of this procedure during the performance of project activities.

3.2 Quality Assurance Officer - The Quality Assurance Officer is responsible for approving this procedure and performing surveillances to verify compliance with this procedure.

3.3 Site Health and Safety Offier - The Site Health and Safety Officer (HSO) is responsible for preparation and modification of the Site-Specific Health and Safety Plan (SSHASP), enforcing the requirements of the SSHASP, evaluating the effectiveness of the SSHASP, stopping work as required, and observing on-site project personnel for signs of stress, illness, or injury.

3.4 Field Personnel - Field personnel are responsible for meeting the requirements of this procedure and of the SSHASP.

3.5 Sampling and Analysis Supervisor (SAS) - The SAS is responsible for the implementation of this procedure. The SAS shall select qualified personnel to perform this activity.

4.0 MATERIALS/EQUIPMENT AND CALIBRATION REQUIRED

None

5.0 METHOD

5.1 Related Procedures - A review of related SOPs for each task is necessary prior to every operation. The related SOPs are listed in Section 8.0. Constant review of the SOPs will ensure that the work performed in the field is legally defensible, well documented, cost effective, and, in some cases, are important for protecting the environment and the health and safety of workers.

5.2 Preparation

5.2.1 Office

5.2.1.1 Personnel should review the Sampling and Analysis Plan (DOE, 1993) and associated documentation for a specific operation and obtain all information related to the purpose and intent of the field program. This may include (but is not limited to) the documents listed below.

- The scope of work or sampling plan
- Previous reports related to the site
- Reports related to the area
- Site maps
- Area maps
- Access agreements
- The subcontractor's work plan
- Data collection and equipment checklists
- Associated SOPs
- Collection permits, etc.

5.2.1.2 Field personnel are expected to maintain a good working relationship with the client, co-workers, and subcontractors.

5.2.1.3 Project information shall be released to the public or press by the U.S. Department of Energy (DOE) Project Director only. Other project personnel, to whom requests for such information may be made, shall refer the question to the appropriate DOE representative.

5.2.1.4 Obtain and test all equipment needed for the task. See equipment lists for specific SOPs.

5.2.1.5 Most sample analyses must be performed within a stringent time period. In addition, laboratories are vulnerable to heavy overloads. Contact the laboratory before sampling activities begin to ensure that the personnel are aware of specific requirements for analysis and can complete the work within the holding times based on the project sampling schedule.

5.2.1.6 Prevent delays at the freight office by contacting the carrier before arrival with a shipment. The carrier can supply information on regulations and specifications for shipping, the address of the nearest delivery office, and the time of the next freight pickup in the area. (**Note**: Due to the remoteness of the Project Chariot Site, one IT person will accompany the samples from the site to Anchorage or Kotzebue, Alaska, where the samples will be turned over to Federal Express for completion of delivery to the laboratory. Chain-of-Custody procedures will be maintained throughout the delivery.)

5.2.2 Documentation

5.2.2.1 Obtain and complete Field Activity Daily Logs (FADLs) and appropriate data collection forms. See SOP-CHR-01, Sample Collection and Documentation, for an example of a FADL. Record all measurements, observations, and instrument readings on the forms according to the instructions provided.

5.2.2.2 Make all entries in black ink that is not water soluble (not a felt-tip pen). To change an entry, draw a single line through it, add the correct information above it, and initial the change.

5.2.2.3 Make an entry in each blank. Where there is no data entry, enter UNK for Unknown, NA for Not Applicable, or ND for Not Done. If any procedure was not performed as prescribed, give the reason for the change or omission on the form. Reference all variances or nonconformances. Information not provided for on forms should be entered in the FADL.

5.2.3 Field

5.2.3.1 Check the condition and operation of all supplies and equipment at the site. Perform calibration checks as specified in the operator's manuals or in the appropriate SOPs.

5.2.3.2 Establish exclusion zones, decontamination zones, and any necessary barricades to public access.

5.3 Operation

5.3.1 The field personnel shall monitor and provide technical direction for the field work, logging samples, collecting measurements, and packaging and shipment of samples.

5.3.2 Under direction of the IT Project Manager, field personnel may designate sampling locations, types and depths of samples, record procedures, materials, and all activities conducted in compliance with the Sampling and Analysis Plan (DOE, 1993) and the SSHASP.

Note: Whenever a sample is collected, a Chain-of-Custody/Request For Analysis (COC/RFA) Form must be initiated and a sample identification label affixed to the sample container. SOP-CHR-01, Sample Control and Documentation, contains examples of these forms and instructions for completing the forms.

5.3.3 Additional duties that the field personnel may perform as assigned by the IT Project Manager, are described below.

5.3.3.1 Record on the FADL, information concerning equipment, personnel, site visitors, and activities (start and stop times, supplies used, site observations, etc.), as well as weather or other site-related conditions affecting the activities. The field personnel should note all relevant instructions and information. All information pertaining to a field activity shall be entered on a FADL with consecutively numbered pages.

5.3.3.2 Notify the IT Project Manager of daily activities and provide a progress report.

5.3.3.3 Complete all data collection forms according to applicable instructions as work progresses.

5.3.3.4 Observe whether field personnel follow the applicable health and safety requirements. If violations occur, the field personnel should immediately notify the IT Project Manager and the Site Health and Safety Officer and correct the infraction.

5.3.3.5 Monitor personnel and equipment for contamination and record results on appropriate forms or on the FADL.

5.3.3.6 Supervise decontamination of equipment and personnel. Record procedures used for decontamination on the FADL.

5.3.3.7 Notify the IT and DOE Project Managers of any modification to the project documents that may be appropriate. Work not defined in the Sampling and Analysis Plan (DOE, 1993) should not be initiated without approval of the IT and DOE Project Managers.

5.4 Post Operation

5.4.1 Field

5.4.1.1 Verify that all equipment is accounted for and decontaminated (see SOP-CHR-04, Field Decontamination).

5.4.1.2 Restore the site to presampling conditions. Restoration can include repair of damage to the land surface, as well as restoration anticipated at the time the Sampling and Analysis Plan (DOE, 1993) was prepared.

5.4.1.3 Mark sample locations or survey points with wooden stakes (or equivalent) or flags. Write the location ID on the marker or flag so that it is readily visible. Use a black marker for marking wooden stakes and flags.

5.4.1.4 Shipping samples is the last task in most field operations. SOP-CHR-01 shall be used as a guide to sample handling and documentation. SOP-CHR-09, Shipment of Samples, shall be used for screening, packaging and shipping samples.

5.4.2 Documentation

5.4.2.1 Record any restoration work on the FADL.

5.4.2.2 Record any uncompleted work on the FADL. This record may include sampling that could not be performed or damage that could not be repaired.

5.4.2.3 Complete FADL entries, verify the accuracy of entries, and sign and date all pages.

5.4.2.4 Review data collection forms for completeness.

5.4.3 Field Office

5.4.3.1 Deliver original forms and FADLs to the IT Project Manager for technical review. The Project Manager will review and sign the forms, as appropriate, and submit them to the project central files at the completion of the project.

5.4.3.2 Inventory equipment and supplies. Repair or replace all broken or damaged equipment. Replace expendable items. Return equipment to the responsible equipment manager and report incidents of malfunction or damage.

5.4.3.3 If samples have been collected for analysis, contact the analytical laboratory to verify that samples arrived safely and instructions for sample analyses are clearly understood.

6.0 REQUIRED INSPECTION/ACCEPTANCE CRITERIA

None

7.0 RECORDS

7.1 Field Activity Daily Logs

7.2 Other forms as specified in the activity-specific SOPs.

8.0 REFERENCES

8.1 Requirements and Specifications

U.S. Department of Energy, Nevada Operations Office, July 1993, "Sampling and Analysis Plan," *Project Chariot: 1962 Tracer Study Site Assessment and Remedial Action Plan*, Appendix A, DOE/NV/93-085, Las Vegas, Nevada.

8.2 Related Procedures

8.2.1 SOP-CHR-01, Sample Control and Documentation

8.2.2 SOP-CHR-04, Field Decontamination

8.2.3 SOP-CHR-07, Sediment Sampling

8.2.4 SOP-CHR-08, Surface Water Sampling

8.2.5 SOP-CHR-09, Shipment of Samples

8.2.6 SOP-CHR-10, Surface Soil Sampling

8.3 Other

None

9.0 ATTACHMENTS

None

This page intentionally left blank

INTERNATIONAL
TECHNOLOGY
CORPORATION

ITLV

STANDARD OPERATING PROCEDURE

NUMBER: CHR-03

TITLE: **Walk-over Surveys Using A Large Volume Scintillation Detector**

APPROVED: Joseph D. Yeasted — ITLV Program Manager **DATE:** 7/9/93

APPROVED: Andrea M. Hopf — ITLV Project Manager **DATE:** 7-9-93

APPROVED: Cheryl D. Prince — ITLV Quality Assurance Officer **DATE:** 7-9-93

CONTROLLED COPY NO. : ____

Revision No.	**Date**

TABLE OF CONTENTS

1.0 SCOPE AND OBJECTIVE

1.1 Scope - This procedure provides instruction for measurement techniques to be used when using a large volume scintillation detector (referred to as a Sodium Iodide [NaI] Detector for the remainder of the text) for a gamma radiation walk-over survey of the 1962 Tracer Study Test Plot Area of the Project Chariot Site.

1.2 Objective - The objective of this procedure is to provide sufficient direction to allow qualified individuals to perform uniform and reliable radiation surveys of a defined area.

2.0 DEFINITIONS

2.1 Calibration - The check or correction of the accuracy of a measuring instrument to assure proper operational characteristics.

2.2 Rectilinear - Moving or forming a straight line.

2.3 Reproducible geometry - A spatial configuration of a radiation detection instrument, in relation to a source, that is specified in sufficient detail to allow each source check performed to obtain comparable results.

2.4 Shall- The word shall denotes a requirement.

2.5 Should - The word should is used when an element is recommended.

2.6 Sodium Iodide (NaI) Detector - A scintillation crystal device which is very effective in the detection of gamma radiation.

3.0 RESPONSIBILITIES AND QUALIFICATIONS

3.1 IT Project Manager - The IT Project Manager is responsible for assuring the implementation of this procedure during the performance of project activities.

3.2 Sampling and Analysis Supervisor (SAS) - The SAS is responsible for the implementation of this procedure. It is the responsibility of the SAS to select personnel that are experienced with this procedure and NaI detectors to perform this activity.

3.3 Quality Assurance Officer - The Quality Assurance Officer is responsible for approving this procedure and performing surveillances to verify compliance with this procedure.

3.4 Field Personnel - Field personnel are responsible for meeting the requirements of this procedure and the Site-Specific Health and Safety Plan (SSHASP).

4.0 MATERIALS/EQUIPMENT AND CALIBRATION REQUIRED

4.1 Materials/Equipment

- Site map
- Weighted flags
- Surface Measurements Field Log
- Eberline ESP-2, or equivalent
- 3- by 3-inch Sodium Iodide (NaI) Detector
- Canberra Multichannel Analyzer (MCA), or equivalent
- External frame backpack
- Batteries
- Radiation Check Source
- Lead shield for NaI Detector
- Adjustable tie-down straps
- Walking/support stick
- Field Activity Daily Log (FADL).

4.2 Calibration Required

4.2.1 The instruments being used shall be calibrated prior to use at least annually and have a current calibration certificate.

4.2.2 Any instrument exceeding the stated calibration expiration date shall not be used and shall be tagged "out of service".

4.2.3 Operational and source checks shall be performed and recorded before and after an instrument is used. Refer to SOP-CHR-14, Operation of a Multichannel Analyzer, and SOP-CHR-15, Operation of a Mobile Sodium-Iodide Detector System.

5.0 METHOD

5.1 Instruments

5.1.1 Two NaI systems will be used for the walk-over surveys. Both systems will use a 3- by 3-inch NaI cylindrical detector that is shielded with a lead carrying shield.

5.1.2 The first system will couple the NaI detector with an Eberline ratemeter Model ESP-2 (referred to as ESP-2 system for remainder of text). The ESP-2 system will be used to collect background readings, walk-over readings and grid-node readings (which will be used to correlate with PIC readings [SOP-CHR-17, Correlation of Sodium Iodide Readings with Pressurized Ion Chamber]). The operation of this instrument is explained in SOP-CHR-15.

5.1.3 The second system will couple the NaI detector with a Canberra, Multichannel Analyzer (referred to as an in-situ NaI system for the remainder of the text). The in-situ NaI system will be used to collect background readings and collect in-situ measurements. The in-situ measurements will be used to determine the concentration of selected radionuclides in order to assess whether or not soil sampling or remediation should take place. The operation of this instrument is explained in SOP-CHR-14.

5.2 Walk-over Survey

5.2.1 If the instrument is properly calibrated and in proper working order, proceed to the assigned grid area (refer to SOP-CHR-12, Visual Inspection and Documentation of Test Plots) and begin counting in normal ratemeter mode.

5.2.2 Record the count rate detected at each grid corner with the ESP-2 system. This measurement should be collected at approximately 1 meter from the ground. Transfer this count rate to the Surface Measurements Field Log (Attachment A).

5.2.3 Prior to using the ESP-2 system to collect readings, the ESP-2 alarm setting will be adjusted to alarm at levels greater than the 95 percent lower limit of detection (LLD) for Cesium-137 (refer to SOP-CHR-16, Determination of Lower Limits of Detection) so that during walk-over surveys, areas that cause the ESP-2 alarm to go off will be marked by a weighted flag.

5.2.4 Use two people for the following steps:

5.2.4.1 Place backpack on back and adjust to comfortable position.

5.2.4.2 Suspend ESP-2 ratemeter from front using backpack straps. Drape cables to detector locations and away from arm swing.

5.2.4.3 The person wearing the backpack should support herself/himself with a walking stick while second person handles and connects detectors. The second person shall adjust the detectors to 1 meter above ground.

5.2.4.4 The second person shall response-check detectors.

5.2.4.5 Enter time, date and location on the Surface Measurment Field Log.

5.2.4.6 The two-person team shall walk the designated pattern at approximately 1 meter/second using walking sticks at all times.

5.2.4.7 The two-person team shall take a 2-minute rest every 10 minutes. The surveyor shall not exceed 2 hours of carrying the backpack without a 1 hour break. Rest 1 hour between each 2 hours or rotate personnel.

5.2.4.8 If alarm sounds, the team shall walk six steps in the pattern beyond alarm point and return over same path. If alarm fails to sound on second pass, the team shall walk to six steps beyond, then continue (crossing the point again) along original path. If an alarm sounds two out of three times, the team shall flag the location and note it on their log. The in-situ NaI system will be used at this location to collect measurements per SOP-CHR-14.

5.2.5 After walk-over of a grid is completed, the ESP-2 system survey results will be logged on the Surface Measurements Field Log.

5.2.6 Return to each location which has been flagged and perform a systematic survey beginning at the flag and working outward to determine the areal extent of the elevated reading. This should be performed with the ESP-2 system surveying near the ground surface.

5.2.7 Record the approximate location and areal extent of the elevated reading on the Surface Measurements Field Log.

5.2.8 Using the in-situ NaI system, hang the NaI detector 1 meter from ground surface above the flagged area. The NaI detector will be hung using a tripod, and the in-situ NaI system's MCA will record a 10-minute measurement at this area. Refer to procedure SOP-CHR-14 for data interpretation.

5.2.9 Record the in-situ NaI system measurement for Cs-137 on the Surface Measurements Field Log.

5.2.10 If the measurement of Cs-137 is above the 95 percent LLD, then collect soil samples as outlined in SOP-CHR-10.

6.0 REQUIRED INSPECTION/ACCEPTANCE CRITERIA

Calibration check measurements of radiation survey instruments must be within three standard deviations of the mean. If two consecutive measurements fall outside this limit, the instrument must be taken out of service until it is recalibrated.

7.0 RECORDS

The following records, generated as a result of implementation of this procedure, shall be retained as quality records in accordance with DOE Order 1324.2A, Records Disposition and IT QA Program requirements.

- Surface Measurements Field Log

8.0 REFERENCES

8.1 Requirements and Specifications

8.1.1 American National Standards Institute, Report No. ANSI N323-1978, "Instrumentation Test and Calibration," 1978.

8.1.2 United States Department of Energy," Draft - Environmental Implementation Guide for Radiological Survey Procedures," 1992.

8.1.3 Eberline Ratemeter Model ESP-2, or equivalent, Instruction Manual

8.1.4 Canberra Portable MCA, or equivalent, Instruction Manual

8.2 Related Procedures

8.2.1 SOP-CHR-10, Surface Soil Sampling

8.2.2 SOP-CHR-12, Visual Inspection and Documentation of Test Plots

8.2.3 SOP-CHR-14, Operation of Multichannel Analyzer

8.2.4 SOP-CHR-15, Operation of Mobile Sodium-Iodide Detector System

8.2.5 SOP-CHR-16, Determination of Lower Limits of Detection

8.2.6 SOP-CHR-17, Correlation of Sodium Iodide Readings with Pressurized Ion Chamber

8.2.7 SOP-CHR-18, Daily Source and Background Checks

8.3 Other

None

9.0 ATTACHMENTS

Attachment A - Surface Measurements Field Log

ATTACHMENT A

SURFACE MEASUREMENTS FIELD LOG
(Page 1 of 1)

Surface Measurements Field Log

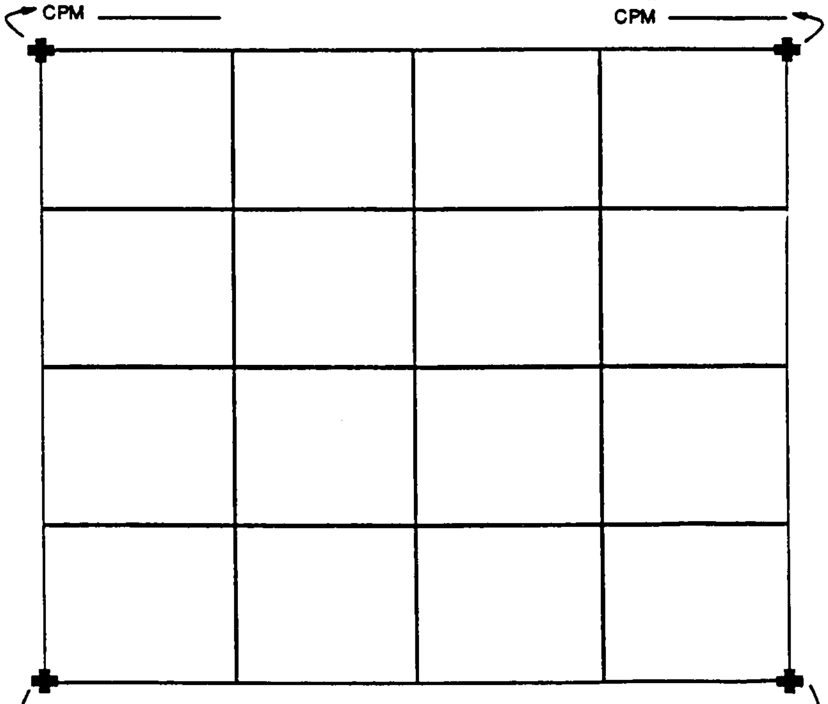
CHARIOT SITE Surface Measurements Field Log

AREA: ____________________
SURVEYORS: ____________________
RECORDED BY: ____________________
BACKGROUND: ____________________

DATE:

TIME:

N ________ N ________
E ________ E ________
CPM ________ CPM ________



N ________ N ________
E ________ E ________
CPM ________ CPM ________

SCALER MODEL: ESP-2 SERIAL NO.: ________
PROBE MODEL: NaI SERIAL NO.: ________
MCA MODEL: ________ SERIAL NO.: ________
PROBE MODEL: NaI SERIAL NO.: ________

COMMENTS: ____________________

INTERNATIONAL
TECHNOLOGY
CORPORATION

ITLV

STANDARD OPERATING PROCEDURE

NUMBER: CHR-04

TITLE: Field Decontamination

APPROVED: ______________________ **DATE:** 7/9/93
ITLV Program Manager

APPROVED: ______________________ **DATE:** 7-9-93
ITLV Project Manager

APPROVED: ______________________ **DATE:** 7-9-93
ITLV Quality Assurance Officer

CONTROLLED COPY NO. : _____

REVISION NO.	**DATE**

TABLE OF CONTENTS

1.0 SCOPE AND OBJECTIVE

1.1 Scope - This procedure provides the methods for the decontamination of field equipment potentially contaminated during sample collection and through use of excavation/removal equipment for conducting field investigations at the 1962 Tracer Study Test Plot Area of the Project Chariot Site.

1.2 Objective - The objective of this procedure is to provide guidelines to maintain a clean working environment for the safety of all field personnel and to not introduce part of one sample into a second sample during sample collection and or storage by ensuring that field equipment is properly decontaminated.

2.0 DEFINITIONS

2.1 Cross-contamination - A type of positive contamination caused by the introduction of part of one sample into a second sample during sampling or storage.

2.2 dpm - disintegrations per minute; a unit used to measure radioactivity.

2.3 May - The word may is used to denote permissibility.

2.4 Shall - The word shall denote a requirement.

2.5 Should - The word should is used when an element is recommended.

3.0 RESPONSIBILITIES AND QUALIFICATIONS

3.1 IT Project Manager - The IT Project Manager is responsible for assuring the implementation of this procedure during the performance of project activities.

3.2 Health and Safety Officer - The Health and Safety Officer (HSO) is responsible for verifying the implementation of this procedure.

3.3 Sampling and Analysis Supervisor (SAS) - The SAS shall select qualified personnel to perform this activity.

3.4 Quality Assurance Officer - The Quality Assurance Officer is responsible for the development and maintenance of this procedure.

3.5 Field Personnel - Field Personnel are responsible for meeting the requirements of this procedure and the Site-Specific Health and Safety Plan (SSHASP).

4.0 MATERIALS/EQUIPMENT AND CALIBRATION REQUIRED

4.1 Materials/Equipment

See Attachment A for complete list.

4.2 Calibration

The smear counter shall be calibrated by an external agency annually, and source checks shall be performed at the beginning and end of shift as a minimum and as necessary during the shift.

5.0 METHOD

5.1 Preparation

5.1.1 Office

5.1.1.1 Review the SOPs listed in Section 8.0 and the SSHASP.

5.1.1.2 Coordinate schedules/actions with the field staff.

5.1.1.3 Assemble the equipment and supplies listed in Attachment A. Verify the proper operation of all decontamination equipment.

5.1.2 Field

5.1.2.1 Assemble containers and equipment for decontamination.

5.1.2.2 Assemble decontamination pad inside the Contamination Reduction Zone (CRZ). See Attachment B for layout.

An equipment decontamination pad will be constructed in the CRZ using 60-millimeter (mils) polyethylene sheeting and wooden railroad ties (6- by 6-inch). An area of an approximate size of 10 feet by 10 feet will be identified within the CRZ. The polyethylene sheeting will be placed directly onto the ground surface with the wooden railroad ties serving as a berm on all four sides. The lower sheeting will be wrapped around the boards and will be overlain by a second layer of polyethylene sheeting to provide containment. A layer of granular absorbent material will be applied over the sheeting to absorb the liquid generated by the decontamination process. Upon completion of the decontamination process, additional absorbent material will be added, as necessary, to remove all free water within the decontamination pad. The contents of the pad and the sheeting will be manually loaded into B-25 LSA containers (90 cubic-foot capacity metal boxes) for disposal.

5.2 Operation - The extent of known contamination determines the extent to which equipment must be decontaminated. If the extent of contamination cannot be readily determined, clean the equipment on the assumption that it is contaminated until enough data is available to allow an accurate assessment of the level of contamination.

Perform decontamination in the same level of protective clothing as sampling activities, unless a different level of protection is specified by the HSO.

5.2.1 Decontamination of Equipment

5.2.1.1 Remove excess soil from equipment by scraping with trowel, or other tool, and place excess soil next to the sample excavation location.

5.2.1.2 Residual soil should be wiped off equipment with a paper towel.

5.2.1.3 Survey towel with radiation instrument (Refer to SOP-CHR-27, Operation of the Geiger-Mueller [G-M] [Pancake] Detector and Survey Meter).

5.2.1.4 If count rate is in excess of 100 counts per minute above background count rate with the Geiger-Mueller (G-M) detector, then place towel in plastic bag for "contaminated" trash.

5.2.1.5 If not, then place towel in "clean" trash bag.

5.2.1.6 Use smear and wipe equipment along the equipment's soil contact surfaces. (Refer to SOP-CHR-26, Smear Sample Collection and Analysis.)

5.2.1.7 The smear will be analyzed qualitatively according to SOP-CHR-26 with the G-M detector.

5.2.1.8 Survey the smear with the G-M detector and if count rate is in excess of 100 counts per minute above the background count rate, then place smear in "contaminated" trash and repeat steps 5.2.1.2 through 5.2.1.6 until clean.

5.2.1.9 If smear is "clean", then place it in clean trash, and equipment can be reused.

5.2.1.10 If after several cleanings the equipment is still not "clean", put it in "contaminated" trash if it is disposable, or put in separate bag to be taken to decontamination pad for cleaning.

5.2.2 Heavy Equipment Decontamination

5.2.2.1 Remove excess soil by scraping with trowel, or other tool, and place excess soil next to the sample excavation location.

5.2.2.2 Move equipment to decon pad.

5.2.2.3 Clean equipment with steam cleaner and other appropriate tools such as brushes.

5.2.2.4 Verify that equipment has been appropriately cleaned by surveying it with G-M detector; if count rate is greater than 100 counts per minute above the background count rate, then repeat 5.2.2.3 until survey is less than 100 counts per minute above background.

5.2.2.5 After steam cleaning, allow equipment to air dry.

5.2.2.6 Store polyethylene sheeting used in decontamination of equipment until next use.

5.2.2.7 Wipe samples will be taken in accordance with the SSHASP at pre-determined locations for each piece of equipment. The wipe samples will be analyzed onsite utilizing the methods specified in the SSHASP. In the event that the analysis results indicate levels exceeding those identified in the SSHASP (which are U.S. Department of Energy [DOE] release values specified in DOE Order 5480.11), the decontamination process will be repeated until the specified level is achieved and approved and certified by the HSO and the IT and DOE Project Managers.

5.2.2.8 At the completion of all field activities, disassemble the decontamination pad and manually load the contents into the B-25 LSA containers for disposal.

5.2.3 Documentation - Radiological measurements will be documented on Radiological Survey Log (Attachment C) will include the following:

- Results from smear counter
- Results of radiation surveys of decontaminated equipment
- Approximate radiological activity of soil and equipment that could not be decontaminated
- Approximate volume of waste that may be disposed of as radioactive.

5.2.4 Office

5.2.4.1 Deliver Field Activity Daily Forms (FADLs) (see SOP-CHR-01, Sample Collection and Documentation) and other pertinent field documents to the IT Project Manager for technical review.

5.2.4.2 Inventory equipment and supplies. Repair or replace all broken or damaged equipment. Replace expendable items. Return equipment to the equipment manager and report incidents of malfunction or damage.

6.0 REQUIRED INSPECTION/ACCEPTANCE CRITERIA

Decontaminated equipment wipe-sample results shall not exceed activity levels/concentrations stipulated in DOE Order 5480.11. If these levels are exceeded, the equipment must be disposed as radioactive waste.

7.0 RECORDS

The following record, generated as a result of implementation of this procedure, shall be retained as a quality record in accordance with DOE Order 1324.2A, Record Disposition and IT QA Program requirements.

7.1 Field Activity Daily Log

7.2 Radiological Survey Log

8.0 REFERENCES

8.1 Requirements and Specifications

8.1.1 U.S. Department of Energy, Nevada Operations Office, 1993, Sampling and Analysis Plan," Appendix A, Project Chariot: Remedial Action Plan, DOE/NV/93-085, Las Vegas, Nevada.

8.1.2 DOE Order 5480.11 "Radiation Protection for Occupational Workers".

8.1.3 U.S. Department of Energy, Nevada Operations Office, July 1993, *Project Chariot: 1962 Tracer Study Site Assessment and Remedial Action Plan*, DOE/NV/93-085, Las Vegas, Nevada.

8.2 Related Procedures

8.2.1 SOP-CHR-01, Sample Collection and Documentation

8.2.2 SOP-CHR-02, General Field Instructions

8.2.3 SOP-CHR-05, Shipment of Remedial-Action-Derived Waste

8.2.4 SOP-CHR-26, Smear Sample Collection and Analysis

8.2.5 SOP-CHR-27, Operation of the Geiger-Mueller (Pancake) Detector and Survey Meter

8.3 Other

None

9.0 ATTACHMENTS

9.1 Attachment A - Equipment and Supplies

9.2 Attachment B - Decontamination Area Layout

9.3 Attachment C - Radiological Survey Log

ATTACHMENT A

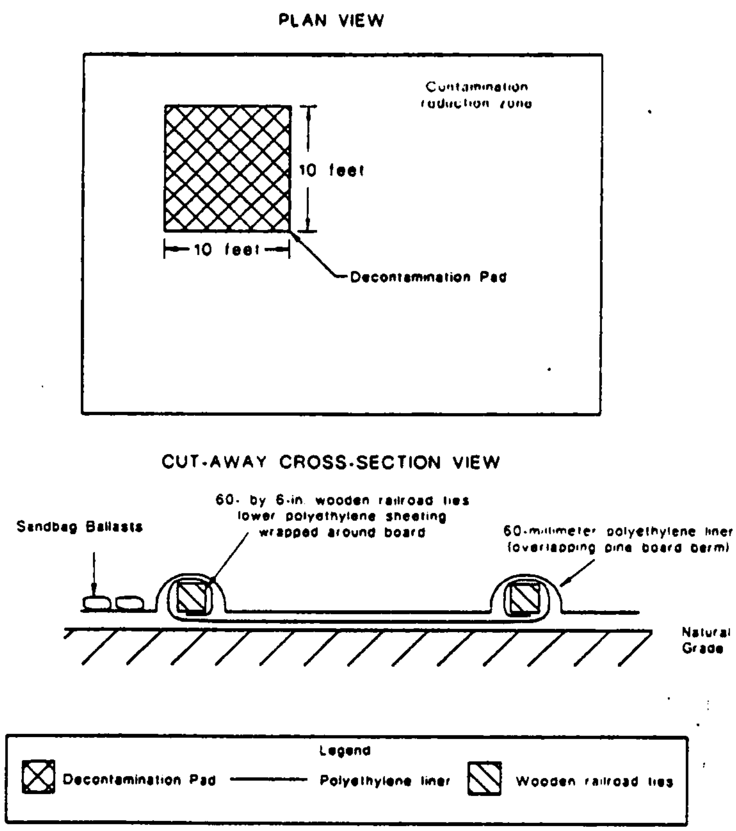
EQUIPMENT AND SUPPLIES
(Page 1 of 1)

The following equipment and supplies are required to perform this procedure:

- B-25 LSA containers (90 ft^3 capacity metal boxes)
- Field Activity Daily Logs
- Polyethylene sheeting (60-mil, 240-300 ft^2)
- Wooden railroad ties (6-inch by 6-inch by 10 ft, 4 each)
- Steam cleaning equipment
- Paper/cloth smears
- Smear counting equipment
- Paper towels or paper/cloth wipes
- Plastic garbage bags
- Radiation survey equipment (i.e., Geiger-Mueller Detector)
- Brushes

ATTACHMENT B

DECONTAMINATION AREA LAYOUT
(Page 1 of 1)



ITEM	UNIT	QUANTITY	DESCRIPTION
1. Polyethylene liner	square feet	240-300	60-millimeter
2. Wooden railroad ties	feet	4	6-in. x 6-in. x 10-ft
3. Granular adsorbent material	pounds	200	— — — —

ATTACHMENT C

RADIOLOGICAL SURVEY LOG
(Page 1 of 1)

INTERNATIONAL
TECHNOLOGY
CORPORATION

RADIOLOGICAL SURVEY LOG

Survey Number	Survey		Survey By	Description
	Date	Time		

This page intentionally left blank

INTERNATIONAL
TECHNOLOGY
CORPORATION

ITLV

STANDARD OPERATING PROCEDURE

NUMBER: CHR-05

TITLE: **Shipment of Remedial-Action-Derived Waste**

APPROVED: [signature] ITLV Program Manager **DATE:** 7/9/93

APPROVED: [signature] ITLV Project Manager **DATE:** 7-9-93

APPROVED: [signature] ITLV Quality Assurance Officer **DATE:** 7-9-93

CONTROLLED COPY NO. : _____

Revision No.	Date

TABLE OF CONTENTS

1.0 SCOPE AND OBJECTIVE

1.1 Scope - This procedure provides the requirements for the completion of the documentation for transporting remedial-action-derived waste from the Project Chariot Site. These waste materials may or may not meet the U.S. Department of Transportation (DOT) definition of a radioactive material, depending upon characterization results. In any case, the wastes will be shipped to an appropriately licensed facility for final disposition.

This procedure discusses the requirements for shipping waste as both radioactive and nonradioactive. For radioactive shipments, this procedure addresses the requirements for shipping limited-quantity (the least restrictive shipping classification) radioactive materials. Should activity measurements exceed the limits for a limited quantity, revision to this procedure shall be required.

1.2 Objective - The objective of this procedure is to provide instructions for shipping remedial-action-derived waste materials in a manner that promotes the safe transportation of project waste and assures compliance with DOT regulations for such materials.

2.0 DEFINITIONS

2.1 A_2 - The maximum activity of radioactive material (normal form) permitted in a Type A package. The A_2 values for various radionuclides are listed in Title 49 C.F.R. Part 173.435 or may be calculated using methods described in Part 173.433.

2.2 Limited Quantity - A quantity of radioactive material not exceeding the material package limits specified Title 49 C.F.R. Part 173.423 and that conforms to the requirements specified in Title 49 C.F.R. Part 173.421. (These limits and requirements are discussed in Section 5.0.)

2.3 May - The word may is used to denote permissibility.

2.4 Radioactive Material - Material having a specific activity greater than 2,000 picocuries per gram (pCi/g) for soils or 2,000 picocuries per liter (pCi/L) for water.

2.5 Shall - The word shall denotes a requirement.

2.6 Should - The word should is used when an element is recommended.

2.7 Floor Dry®- Packaging material used to absorb any excess moisture that will be in the soil.

3.0 RESPONSIBILITIES AND QUALIFICATIONS

3.1 IT Project Manager - The IT Project Manager is responsible for assuring the implementation of this procedure during the performance of project activities.

3.2 Sampling and Analysis Supervisor (SAS) - The SAS is responsible for the implementation of this procedure. The SAS shall select qualified personnel to perform this activity.

3.3 Field Personnel - Field personnel are responsible for meeting the requirements of this procedure and the Site-Specific Health and Safety Plan (SSHASP).

3.4 Quality Assurance Officer - The Quality Assurance Officer is responsible for approving this procedure and performing surveillances to verify compliance with this procedure.

4.0 MATERIALS/EQUIPMENT AND CALIBRATION REQUIRED

4.1 Materials

- Waste Packages
- Filter paper/cloth for sample smears
- Waste manifest/bill of lading
- Field Activity Daily Log (FADL)
- Labels stating "Radioactive"
- Floor Dry®, absorbent material
- 2-inch red tape

4.2 Equipment and Calibration

4.2.1 Ludlum Model 2929 dual channel scaler with Ludlum Model 43-10-1 Alpha/Beta/Gamma smear counter, or equivalent. This instrument shall be calibrated every six months.

4.2.2 Ludlum micro-R meter, or equivalent. This instrument shall be calibrated every six months.

5.0 METHOD

5.1 Determine the radionuclides of concern and their activity concentrations in the waste. If less than 2,000 pCi/g, ship the materials as nonradioactive. If nonradioactive, proceed to step 5.11. If greater than or equal to 2,000 pCi/g, determine the proper shipping classification.

5.2 Determine the A_2 value of the mixture of radionuclides (Attachment A provides relevant sections of 49 C.F.R. 173.433). For this project, it can be assumed that the identity and activity of each radionuclide is known either by laboratory analysis, estimate based on process knowledge, or field measurements. For a mixture of radionuclides where the identity and activity of each is known, use the following to determine the A_2 value for the mixture.

5.2.1 The permissible activity of radionuclide $R_1, R_2, \ldots R_n$ must be such that $F_1 + F_2 + \ldots F_n$ is not greater than unity when:

$$F_1 = \frac{\text{Total Activity of } R_1}{A_2(R_1)}$$

$$F_2 = \frac{\text{Total Activity of } R_2}{A_2(R_2)}$$

$$F_n = \frac{\text{Total Activity of } R_n}{A_2(R_n)}$$

Where A_2 ($R_1, R_2, \ldots R_n$) is the value for the nuclide $R_1, R_2, \ldots R_n$.

Example: A waste package contains Cs-137 at 3,000 pCi/g and mixed fission products (MFP) at 8,000 pCi/g.

$$\text{Cs-137 } A_2 = 10 \text{ Ci}$$
$$\text{MFP } A_2 = 0.4 \text{ Ci}$$

Assume the waste material contained in a box weighs 9,000 pounds (lbs) (4.086×10^6 grams [g]). The maximum quantity (in grams) of this material allowed in a Type A package is calculated as:

$$\left(\frac{3{,}000 \frac{\text{pCi}}{\text{g}} (g_x)}{10\,\text{Ci}} + \frac{8{,}000 \frac{\text{pCi}}{\text{g}} (g_x)}{0.4\,\text{Ci}} \right) \frac{1\,\text{Ci}}{10^{12}\text{pCi}} = 1$$

$$3\times10^{-10}\,(1/g)(g_x) + 2\times10^{-8}\,(1/g)(g_x) = 1$$

$g_x = 4.93 \times 10^7$g of this material is allowed in a Type A package.

$$(g_x)\ 2.03\times10^{-8} = 1$$

The 9,000 lbs of waste is well within the allowed quantity.

5.3 Determine the appropriate shipping classification based on activity. For shipping materials as a limited quantity, the material package limits of 10^{-3} of the A_2 value (Title 49 C.F.R. Part 173.423, provided in Attachment B) would apply.

Example: A waste package contains Cs-137 at 3,000 pCi/g and MFP at 80 pCi/g.

Cs-137 10^{-3} A_2 = 10,000 microcuries (μCi)
MFP 10^{-3} A_2 = 400 μCi

Assume the waste material contained in a box weighs 4,000 lbs (1.81 x 10^6 g). The maximum quantity of this material in grams allowed in a Limited Quantity package is calculated as:

$$\left(\frac{3{,}000\ \frac{pCi}{g}\ (g_x)}{10{,}000\mu Ci} + \frac{80\ \frac{pCi}{g}\ (g_x)}{400\mu Ci} \right) \frac{10^6 \mu Ci}{10^{12} pCi} = 1$$

$$3\times10^{-7}\ (1/g)(g_x) + 2\times10^{-7}(1/g)(g_x) = 1$$

$g_x = 2 \times 10^6$ g of this material is allowed in a limited quantity package.

Based on the above calculation, the 4,000-lb package can be shipped as a limited quantity.

5.4 If the materials to be transported meet the activity limits of a limited quantity, proceed as follows:

5.4.1 Verify that the waste package was inspected for integrity prior to loading. Check for holes, dents, and deformations.

5.4.2 For soil, a layer of Floor Dry® shall be placed on the bottom of the box and another layer above the solid to absorb any liquid from thawing soil.

5.4.3 Uniquely identify each waste container with a numbering system. Identification numbers shall be labeled or painted on each box/container.

5.4.4 Inspect the box lid for proper installation (e.g., lid clips securely in place, no gaps, and all clips present).

5.4.5 On all four sides of the shipping container, attach labels with arrows indicating the upright position.

5.4.6 Attach a label stating "Radioactive" to the top of the lid and at least one side of the container if applicable.

5.5 Conduct a radiation survey of the package exterior. To be shipped as a Limited Quantity, the external radiation level must be less than 0.5 millirems per hour at any point on the external surface of the package (49 C.F.R. 173.421). Record survey results on the FADL (see SOP-CHR-01, Sample Control and Documentation).

5.6 Collect smear samples from the exterior of the package for removable contamination. Removable alpha levels must be less than 220 disintegrations per minute per 100 square centimeters (dpm/100 cm^2), and removable beta/gamma levels must be less than 2,200 dpm/100 cm^2 (49 C.F.R. 173.443). Record smear sample results on the FADL.

5.7 Complete the shipment manifest/bill. Examples of a bill of lading are shown in Attachments C and D.

5.8 Complete all applicable requirements for waste acceptance at the disposal site.

5.9 Load the containers on the transport vehicle/vessel, and block and brace containers such that they cannot shift during transport.

5.10 Record waste shipment on the FADL.

5.11 Notify the disposal site of the shipment and the expected arrival date.

5.12 If a waste is nonradioactive, perform only Steps 5.4.1 through 5.4.5, and Steps 5.7 through 5.10.

5.13 Verify that the waste shipment arrived at the disposal facility.

6.0 REQUIRED INSPECTION/ACCEPTANCE CRITERIA

All waste packages shall be inspected and monitored by the Waste Certification Official. Requirements for waste certification are specified in the Project Waste Certification Plan.

7.0 RECORDS

The following records, generated as a result of implementation of this procedure shall be retained as quality records in accordance with DOE Order 1324.2A, Record Disposition and IT QA Program requirements.

- Field Activity Daily Log

8.0 REFERENCES

8.1 Requirements and Specifications

8.1.1 U.S. Department of Transportation, Code of Federal Regulations, Title 49

8.2 Related Procedures

8.2.1 SOP-CHR-01, Sample Control and Documentation

8.2.2 SOP-CHR-09, Shipment of Samples

8.2.3 SOP-CHR-26, Smear Sample Collection and Analysis

8.2.4 SOP-CHR-27, Operation of the Geiger-Mueller (Pancake) Detector and Survey Meter

8.3 Other

None

9.0 ATTACHMENTS

9.1 Attachment A - 49 C.F.R. 173.433

9.2 Attachment B - 49 C.F.R. 173.423

9.3 Attachment C - Example Bill of Lading for Radioactive Material

9.4 Attachment D - Example Bill of Lading for Nonradioactive Material

ATTACHMENT A

49 C.F.R. 173.433
(Page 1 of 2)

49 CFR Ch. I (12-31-91 Edition)

Research and Special Programs Administration, DOT

§ 173.433 **Requirements for determination of A_1 and A_2 values for radionuclides.**

(a) *Single radionuclides.* (1) For single radionuclides of known identity, the values of A_1 and A_2 are those given in the table in § 173.435. The values of A_1 and A_2 are also applicable for radionuclides contained in (α,n) or (γ,n) neutron sources.

(2) For any single radionuclide of known identity, which is not listed in § 173.435, the values of A_1 and A_2 shall be determined in accordance with the following:

(i) If the radionuclide emits only one type of radiation, A_1 is determined in accordance with paragraphs (a)(2)(i) (A), (B), (C), and (D) of this section. For radionuclides emitting different kinds of radiation, A_1 is the most restrictive value of those determined for each kind of radiation. However, in both cases, A_1 is restricted to a maximum of 1000 curies. If a parent nuclide decays into a shorter lived daughter, of a half-life not greater than 10 days, A_1 is calculated for both the parent and the daughter, and the more limiting of the two values is assigned to the parent nuclide.

(A) For gamma emitters, A_1 is determined by the expression: $A_1 = 9/\Gamma$ curie

where Γ is the gamma-ray constant, corresponding to the dose in roentgens per hour at 1 meter per curie; the number 9 results from the choice of 1 rem per hour at a distance of 3 meters as the reference dose-equivalent rate.

(B) For x-ray emitters, A_1 is determined by the atomic number (Z) of the nuclide:

$Z \leq 55$ $A_1 = 1000$ curies
for $Z > 55$ $A_1 = 200$ curies

(C) For beta emitters, A_1 is determined by the maximum beta energy (E_{max}) according to Table 8:

TABLE 8—A_1 FOR BETA EMITTERS

E_{max}(MeV)	A_1(curies)
<0.5	1000
0.5–<1.0	300
1.0–<1.5	100
1.5–<2.0	30
≥2.0	10

(D) For alpha emitters, A_1 is determined by the expression:

$A_1 = 1000\ A_2$

where A_2 is the value listed in Table 9:

TABLE 9—A_2 VALUES

	A_2		
Atomic number	Half-life less than 1,000 days	Half-life 1,000 days to 10^6 years	Half-life greater than 10^6 years
1 to 81	3 curies	50 millicuries	3 curies.
82 and above.	2 millicuries	2 millicuries	3 curies.

(ii) For assignment of A_2 values, A_2 is the more restrictive of the following values:

(A) The corresponding A_1.

(B) The value A_2 obtained from Table 9.

(3) For any single radionuclide whose identity is unknown, the value of A_1 is 2 curies and the value of A_2 is 0.002 curies. However, if the atomic number of the radionuclide is less than 82, the value of A_1 is 10 curies and the value of A_2 is 0.4 curies.

(b) *Mixture of radionuclides, including radioactive decay chains.* (1) For mixed fission products, where a detailed analysis of the mixture is not carried out, the following activity limits apply:

(i) $A_1 = 10$ curies.

(ii) $A_2 = 0.4$ curies.

(2) A single radioactive decay chain is considered to be a single radionuclide when the radionuclides are present in their naturally occurring portions and no daughter nuclide has a half-life either longer than 10 days or longer than that of the parent nuclide. The activity to be taken into account and the A_1 or A_2 value to be applied are those corresponding to the parent nuclide of that chain. When calculating A_1 or A_2 values, radiation emitted by daughters must be taken into account. However, in the case of radioactive decay chains in which any daughter nuclide has a half-life either longer than 10 days or greater than that of the parent nuclide, the parent and daughter nuclides are considered to be mixtures of different nuclides.

(3) In the case of a mixture of different radionuclides, where the identity and activity of each radionuclide is known, the permissible activity of each radionuclide $R_1, R_2, \ldots R_n$ must be such that $F_1 + F_2 + \ldots F_n$ is not greater than unity, when—

$$F_1 = \frac{\text{Total activity of } R_1}{A_i(R_1)}$$

$$F_2 = \frac{\text{Total activity of } R_2}{A_i(R_2)}$$

$$F_n = \frac{\text{Total activity of } R_n}{A_i(R_n)}$$

Where A_i ($R_1, R_2 \ldots R_n$) is the value of A_1 or A_2 as appropriate for the nuclide $R_1, R_2 \ldots R_n$

(4) When the identity of each radionuclide is known but the individual activities of some of the radionuclides are not known, the formula given in subparagraph (3) of this paragraph must be applied to establish the values

ATTACHMENT A

49 C.F.R. 173.433
(Page 2 of 2)

of A_1 or A_2 as appropriate. All the radionuclides whose individual activities are not kmown (but whose total activity is known) must be classed in a single group and the most restrictive value of A_1 or A_2 applicable to any one of them shall be used as the value of A_1 and A_2 in the denominator of the fraction.

(5) When the identity of each radionuclide is known but the individual activity of the radionuclides is not known, the most restrictive value of A_1 or A_2 applicable to any one of the radionuclides present is the applicable value.

(6) When the identity of the radionuclides is not known, the value of A_1 is 2 curies and the value of A_2 is 0.002 curies. However, if alpha emitters are known to be absent, the value of A_2 is 0.4 curies.

[Amdt. 173-162, 48 FR 10226, Mar. 10, 1983; 48 FR 13432, Mar. 31, 1983, as amended at 48 FR 31218, July 7, 1983; Amdt. 173-185, 50 FR 11055, Mar. 19, 1985]

ATTACHMENT B

49 C.F.R. 173.423
(Page 1 of 1)

TABLE 7—ACTIVITY LIMITS FOR LIMITED QUANTITIES, INSTRUMENTS, AND ARTICLES

Nature of contents	Instruments and articles		Materials package limits
	Instrument and article limits [1]	Package limits	
Solids:			
Special form	$10^{-2}A_1$	A_1	$10^{-3}A_1$
Other forms	$10^{-2}A_2$	A_2	$10^{-3}A_2$.
Liquids:			
Tritiated water:			
<0.1 Ci/liter			1000 Curies.
0.1 Ci to 1.0 Ci/1			100 Curies.
>1.0 Ci/liter			1 Curie.
Other liquids	$10^{-3}A_2$	$10^{-1}A_2$	$10^{-4}A_2$
Gases:			
Tritium [2]	20 Curies	200 Curies	20 Curies:
Special form	$10^{-3}A_1$	$10^{-2}A_1$	$10^{-3}A_1$
Other forms	$10^{-3}A_2$	$10^{-2}A_2$	$10^{-3}A_2$.

[1] For mixture of radionuclides see § 173.433(b).
[2] These values also apply to tritium in activated luminous paint and tritium adsorbed on solid carriers.

[Amdt. 173-162, 48 FR 10226, Mar. 10, 1983, as amended at 48 FR 13432, Mar. 31, 1983; 48 FR 31218, July 7, 1983]

ATTACHMENT C

EXAMPLE BILL OF LADING FOR RADIOACTIVE MATERIAL
(Page 1 of 1)

STRAIGHT BILL OF LADING
ORIGINAL - NOT NEGOTIABLE

Shipper's No. PC-1
Carrier's No. PC-1

CARRIER: Alaska Barge Co. SCAC Date 1/18/93

TO:		FROM:	
Consignee	DOE Hanford Reservation	Shipper	IT Corporation
Street	1 Hanford Avenue	Street	Project Chariot Site
Destination	Richland, WA Zip 00000	Origin	Anuwhe Alaska Zip 00000

Route: Via barge, project site, up Columbia River to Hanford Reservation — Vehicle Number 00000-0

Number of Shipping Units	O HM	Kind of Packaging, Description of Articles, Special Marks and Exceptions	WEIGHT	RATE	CHARGES
20	X	Radioactive Material, Limited Quantity, n.o.s., UN2910 B-25 Metal boxes (90 ft³/box) containing soil contaminated w/ Cs-137 and Mixed Fission Products "This package conforms to the conditions and limitations specified in 49 CFR 173.421 for excepted radioactive material, limited quantity, n.o.s., UN2910."	200,000 lb	—	—

Remit C.O.D. to: N/A
Address:
City: State: Zip:

COD Amt N/A

C.O.D. FEE: Prepaid ☐ Collect ☐ $N/A

TOTAL CHARGES: $ —

FREIGHT CHARGES

This is to certify that the above-named materials are properly classified, described, packaged, marked and labeled and are in proper condition for transportation according to the applicable regulations of the Department of Transportation.

SHIPPER: Site Manager Signature
PER: IT Corporation
DATE: 1/18/93

CARRIER: Barge Co. Signature
PER: Alaska Barge Co.
DATE: 1/18/93

10-BLS-A3
Revised 6/87

INTERNATIONAL
TECHNOLOGY
CORPORATION

ATTACHMENT D

EXAMPLE OF BILL OF LADING FOR NONRADIOACTIVE MATERIAL
(Page 1 of 1)

STRAIGHT BILL OF LADING
ORIGINAL - NOT NEGOTIABLE

Shipper's No. PC-1

Carrier's No. PC-1

CARRIER: Alaska Barge Co. SCAC Date 1/18/93

TO: Consignee DOE Hanford Reservation — FROM: Shipper IT Corporation

Street 1 Hanford Avenue — Street Project Chariot Site

Destination Richland, WA Zip 00000 — Origin Anchorage, Alaska Zip 00000

Route: — Vehicle Number

No. Shipping Units	HM	Kind of Packaging, Description of Articles, Special Marks and Exceptions	WEIGHT	RATE	CHARGES
20		B-25 Boxes containing soil contaminated with Cs-137 and Mixed Fission Products (non-radioactive per 49 CFR 173.403(y))	200,000 lb.	—	—

Remit C.O.D. to: Address: City: State: N/A Zip:

COD Amt: $ N/A

C.O.D. FEE: Prepaid ☐ Collect ☐ $ N/A

TOTAL CHARGES: $ —

FREIGHT CHARGES

This is to certify that the above-named materials are properly classified, described, packaged, marked and labeled and are in proper condition for transportation according to the applicable regulations of the Department of Transportation. Per

SHIPPER: Site Manager Signature — CARRIER: John Doe Signature

PER: IT Corporation — PER: Alaska Barge Co.

DATE: 1/18/93 — DATE: 1/18/93

10-BLS-A3
Revised 6/87

INTERNATIONAL
TECHNOLOGY
CORPORATION

ITLV

STANDARD OPERATING PROCEDURE

NUMBER: CHR-06

TITLE: **Field Activity Photographs**

APPROVED: ____________________ **DATE:** 7/9/93
ITLV Program Manager

APPROVED: ____________________ **DATE:** 7-9-93
ITLV Project Manager

APPROVED: ____________________ **DATE:** 7-9-93
ITLV Quality Assurance Officer

CONTROLLED COPY NO. : _____

REVISION NO.	**DATE**

TABLE OF CONTENTS

1.0 SCOPE AND OBJECTIVE

1.1 Scope - This procedure provides requirements for the proper documentation of photographs and videotapes made of field activities performed or field conditions. These requirements apply to all photographs and videotapes made for project records.

1.2 Objective - The objective of this procedure is to provide sufficient instructions to properly identify each photograph or video, and properly record all relevant information.

2.0 DEFINITIONS

2.1 May - The word may is used to denote permissibility.

2.2 Shall - The word shall denotes a requirement.

2.3 Should - The word should is used when an element is recommended.

3.0 RESPONSIBILITIES AND QUALIFICATIONS

3.1 IT Project Manager - The IT Project Manager is responsible for assuring the implementation of this procedure during the performance of project activities.

3.2 Sampling and Analysis Supervisor (SAS) - The SAS is responsible for the implementation of this procedure. The SAS shall select qualified personnel to perform this activity.

3.3 Quality Assurance Officer - The Quality Assurance Officer is responsible for approving this procedure and performing surveillances to verify compliance with this procedure.

3.4 Field Personnel - Field personnel are responsible for meeting the requirements of this procedure and the Site-Specific Health and Safety Plan (SSHASP).

4.0 MATERIALS/EQUIPMENT AND CALIBRATION REQUIRED

The following equipment and supplies are required for this procedure:

- Field forms as listed in Section 7.0
- Camera or video recorder
- Field logbook/Field Activity Daily Logs (FADLs)
- Film or blank videotape
- Lens paper
- Appropriate lenses
- Film storage canisters
- Batteries.

5.0 METHOD

5.1 Preparation

5.1.1 Office

5.1.1.1 Review the SOPs listed in Section 8.0.

5.1.1.2 Coordinate schedules/actions with the field staff.

5.1.1.3 Assemble the equipment and supplies listed in Section 4.0. Ensure the proper operation of all photographic equipment and that there are adequate supplies of film.

5.1.2 Documentation

5.1.2.1 Obtain and start a FADL (see SOP-CHR-01, Sample Control and Documentation) and a Photographic Log Form (sample provided in Attachment A).

5.1.2.2 Label each roll of film or videotape prior to placement in the camera or video camera. Record assigned number on the label and FADL and indicate if it is film or videotape.

5.1.2.3 Record the type of camera, lens, f-stop, shutter speed, and film used, if for photographs.

5.1.2.4 Record the identification number of the video camera, the speed of recording, and length of tape (e.g., 30 minute length).

5.1.3 Field - Record all pertinent information (i.e., date, site, project number, and location) on the FADL. Note field conditions, unusual circumstances, and weather conditions.

5.2 Operation

5.2.1 Photograph Identification

5.2.1.1 All photographs taken by field personnel shall be identified on the back of the print with the required information. Limit comments to pertinent information.

5.2.1.2 Photographs should be taken with a perspective similar to that afforded by the naked eye, not telephoto or wide-angle shots.

5.2.1.3 An example of the photographic log is provided in Attachment A. Information to be recorded on the photographic log includes:

- Date and time
- Signature of photographer
- Name and identification number of site/project
- Type of camera, lens, f-stop, shutter speed, and film used
- General direction faced
- Accurate description of the subject
- Distance from photographer to object

- Location at the site
- Sequential number of photograph and the roll number.

5.2.2 Videotape Identification

5.2.2.1 Label each videotape with the project name, project number, and the specific activity being recorded.

5.2.2.2 Enter on a FADL information relevant to the activity being recorded. This information must include all information required on the form and the following additional information.

- Name of video camera operator
- Type of video camera used
- Speed at which recorded
- Location of site
- General direction faced
- Accurate description of the subject
- Distance from photographer to the subject
- Footage at start and stop, if available on camera.

5.2.2.3 Use a camera with automatic data and time feature, when possible. Verify the feature is turned on before the start of recording.

5.2.2.4 When the camera being used has audio recording capability, record verbal descriptions and details, in addition to written record. (Spoken record must not replace written record but is in addition to the log.)

5.2.3 Additional Requirements and Limitations - If a photograph is taken with a Polaroid camera, the information shall be entered on the back of each photograph as soon as it is taken. If a 35 mm camera is used, a serial type record of each frame exposed shall be kept in the Photographic Log along with the information required for each photograph. The film shall be developed with the negatives supplied uncut. The field investigator shall then enter the required information on the prints, using the serialized photographic record from the log, to identify each photograph.

6.0 REQUIRED INSPECTION/ACCEPTANCE CRITERIA

None

7.0 RECORDS

The following records, generated as a result of implementation of this procedure, shall be retained as quality records in accordance with DOE Order 1324.2A, Record Disposition and IT QA Program requirements.

7.1 Field Activity Daily Logs

7.2 Photographic Logs

8.0 REFERENCES

8.1 Requirements and Specifications

None

8.2 Related Procedures

8.2.1 SOP-CHR-01, Sample Control and Documentation

8.2.2 SOP-CHR-02, General Field Instructions

8.3 Other

8.3.1 U.S. Environmental Protection Agency (EPA), 1987, "A Compendium of Superfund Field Operations Methods," EPA-500/P-87/001, U.S. Government Printing Office, Washington, DC.

8.3.2 U.S. Environmental Protection Agency (EPA), 1991, "Environmental Compliance Branch, Standard Operating Procedures and Quality Assurance Manual," Region IV, Environmental Services Division, Athens, Georgia, U.S. Government Printing Office.

9.0 ATTACHMENTS

Attachment A - Photographic Log

ATTACHMENT A

PHOTOGRAPHIC LOG
(Page 1 of 1)

INTERNATIONAL
TECHNOLOGY
CORPORATION

PHOTOGRAPHIC LOG

Page ____ of ____

PROJECT NAME ____________________

PROJECT NUMBER ____________________

PHOTOGRAPHER ____________________

SITE ____________________

ENGINEER(S) ____________________

ROLL NUMBER ____________________

CAMERA MODEL ____________________

SERIAL NUMBER ____________________

FILM FORMAT: SLIDES ☐ PRINTS ☐

SIZE: ________ SPEED: ________

COMMENTS ____________________

FRAME / NEG. (a)	DIRECTION (b)	DATE (c)	TIME (d)	DESCRIPTION (Location, features, personnel)

(a) FRAME is the exposure number displayed on the camera.
NEG. is the number identification on the negative (as applicable).

(b) One of eight compass directions (e.g. northwest) should be used to describe the direction the camera is pointed. Alternatively an azimuth or relative orientation to a known datum may be used.

(c) The date is expressed for month/day/year.

(d) Time is documented using the 24 hour clock.

4 23 91

This page intentionally left blank

INTERNATIONAL
TECHNOLOGY
CORPORATION

ITLV

STANDARD OPERATING PROCEDURE

NUMBER: CHR-07

TITLE: **Sediment Sampling**

APPROVED: ______________________ **DATE:** 7/9/93
ITLV Program Manager

APPROVED: ______________________ **DATE:** 7-9-93
ITLV Project Manager

APPROVED: ______________________ **DATE:** 7-9-93
ITLV Quality Assurance Officer

CONTROLLED COPY NO. : _____

Revision No.	**Date**

TABLE OF CONTENTS

1.0 SCOPE AND OBJECTIVE

1.1 Scope - This procedure applies to the sediment sampling from site-related surface water bodies to determine if residual radionuclide tracers are present. To reduce errors introduced by field techniques, collection of sediment samples will be done in a consistent manner and use chemically inert sampling materials.

1.2 Objective - The objective of this procedure is to establish a standard method for the collection of sediments that will provide representative samples of the actual site conditions.

2.0 DEFINITIONS

2.1 May - The word may is used to denote permissibility.

2.2 Sediment - Solid material that has settled from a state of suspension in a liquid. In the plural the term is applied to all kinds of deposits and refers to essentially unconsolidated materials.

2.3 Shall - The word shall denotes a requirement.

2.4 Should - The word should is used when an element is recommended.

3.0 RESPONSIBILITIES AND QUALIFICATIONS

3.1 IT Project Manager - The IT Project Manager is responsible for assuring the implementation of this procedure during the performance of project activities.

3.2 Sampling and Analysis Supervisor (SAS) - The SAS is responsible for the implementation of this procedure. The SAS shall select qualified personnel to perform this activity.

3.3 Quality Assurance Officer - The Quality Assurance Officer is responsible for the development and maintenance of this procedure.

3.4 Field Personnel - Field personnel are responsible for meeting the requirements of this procedure and of the Site-Specific Health and Safety Plan (SSHASP).

4.0 MATERIALS/EQUIPMENT AND CALIBRATION REQUIRED

For a complete list of required materials and equipment, see Attachment A.

5.0 METHOD

5.1 Preparation

5.1.1 Field Office

5.1.1.1 Review the SOPs listed in Section 8.0 and the SSHASP.

5.1.1.2 Coordinate schedules/actions with the field staff.

5.1.1.3 Assemble the equipment and supplies listed in Attachment A. Verify the proper operation of all sampling equipment.

5.1.1.4 Notify the laboratory of sample types, the number of samples, and the approximate arrival date.

5.1.1.5 Contact the carrier that will transport samples to obtain information on regulations and specifications.

5.1.2 Documentation

5.1.2.1 Obtain and start a Field Activity Daily Log (FADL) (see SOP-CHR-01, Sample Control and Documentation).

5.1.2.2 Obtain a sufficient number of the appropriate data collection forms (i.e., Sample Collection Logs, and Chain-of-Custody/Request for Analysis [COC/RFA] Forms (see SOP-CHR-01).

5.1.3 Field

Field preparation requires organizing sample containers, sample labels, and documentation in an orderly, systematic manner that promotes consistency and traceability of all data.

5.1.3.1 Before sampling, verify that all equipment is clean by rinsing the equipment in the surface-water three times prior to collecting the sample. Sediment samples will be collected at the same sampling locations as the surface-water samples.

5.1.3.2 Record all pertinent information (date, site name, identification (ID) number, and location) on the FADL and the appropriate data forms. Note field conditions, unusual circumstances, and weather conditions.

5.2 Verifying and Marking Sample Locations - The general sampling areas are predetermined to ensure coverage of the various impact scenarios and are listed in the Sampling and Analysis Plan (SAP). The following steps shall be followed by the sampler to plot each sample location station on the U.S. Geological Survey (USGS) map.

5.2.1 Use the headwaters of Tributary No. 3 of Snowbank Creek as the zero point.

5.2.2 Using the tape measure, measure the horizontal distance between the zero point and the immediate downstream sample location station.

5.2.3 Use an altimeter to measure the vertical position at the sample location station.

5.2.4 Plot the horizontal distance and vertical distance on the topographic map.

5.2.5 Photograph each sample station and the identification marker.

5.2.6 Repeat the above steps for each sample location station.

5.2.7 Coordinates of each sample location shall be determined using the Global Positioning System.

5.3 Collecting Sediment Samples

5.3.1 Record general site information and note sampling event on the FADL. Record specific sampling details on the Sample Collection Log (see SOP-CHR-01) including field survey radiation measurements.

5.3.2 Locate the sample station on the USGS topographic map.

5.3.3 Using the hand core sediment sampler, collect undisturbed sediment cores from locations specified in the project SAP. Cores will be collected from areas of deposition (i.e., fine-grained sediments) and from mid-channel in conjunction with surface water samples.

5.3.4 Core samples shall be collected by using hand core sediment sampler lined with a plastic core liner or other approved sampling device (i.e., stainless steel trowel/spoon or Ekman dredge). Liners shall be used only once and then disposed of in the appropriate waste container.

5.3.5 Handle all media with nitrile gloves or equivalent (PVC surgical).

5.3.6 Cores shall be removed from the plastic liner, and a minimum of 600 grams of the sample media shall be transferred into the 1,000 milliliter wide-mouth polyethylene sample container.

5.3.7 Wipe off the outside of the sample container and complete sample container label (Attachment B).

5.3.8 Secure the sample container lid with an IT custody seal; secure the sample container label by applying clear plastic tape over the label (after ascertaining that the correct information has been transferred to the label) to avoid potential damage to the label. (Note: Steps 5.3.7 and 5.3.8 may be performed prior to sample collection).

5.3.9 The Site Health Physicist, or designee, will survey the sample container and record the measurement on the COC/RFA Form (for lab purposes).

5.3.10 Place the sample container into a one-gallon size Ziploc® bag and seal.

5.3.11 Complete COC/RFA Forms (see SOP-CHR-01) for all samples collected.

5.3.12 Maintain custody of the samples by keeping the samples in actual possession, within view, locked up, sealed to prevent tampering, or placed in a secure area with access restricted to authorized personnel. SOP-CHR-01, Sample Control and Documentation, and SOP-CHR-09, Shipment of Samples, shall be followed for sample handling.

5.4 <u>Post Operation</u>

5.4.1 <u>Field</u>

5.4.1.1 Assure that all equipment is accounted for and decontaminated (see SOP-CHR-04, Field Decontamination).

5.4.1.2 Verify that all sampling locations are properly marked and the location ID is readily visible on the location marker.

5.4.2 <u>Documentation</u>

5.4.2.1 Record on the FADL those locations where sampling was performed.

5.4.2.2 Complete daily log entries, verify the accuracy of the entries, and sign and date all pages.

5.4.2.3 Document the chain-of-custody on the COC/RFA Form.

5.4.2.4 Review data collection forms for completeness.

5.4.3 Field Office

5.4.3.1 Deliver original forms and FADLs to the IT Project Manager for technical review. The Project Manager shall review and sign the forms, as appropriate, and submit them to the project central files at the completion of the project.

5.4.3.2 Inventory equipment and supplies. Repair or replace all broken or damaged equipment. Replace expendable items. Return equipment to the equipment manager and report incidents of malfunction or damage.

5.4.3.3 Contact the laboratory to verify that samples arrived safely and instructions for sample analyses are clearly understood.

5.5 Quality Control

5.5.1 Quality Control Samples will be prepared at the time of sediment sample collection.

5.5.2 The quality control sampling program to be followed is described in the Sampling and Analysis Plan and Quality Assurance Project Plan.

5.5.3 Duplicate samples shall be collected at a frequency of one for every 20 samples, or one per batch.

6.0 REQUIRED INSPECTION/ACCEPTANCE CRITERIA

Sample collection containers shall be inspected for integrity, correct material composition, and correct amount required for the analyses to be performed.

7.0 RECORDS

The following records, generated as a result of implementation of this procedure, shall be retained as quality records in accordance with DOE Order 1324.2A, Record Disposition and IT QA Program requirements.

7.1 Field Activity Daily Log

7.2 Sample Collection Log

7.3 Photodocumentation of sampling activities

7.4 Chain-of-Custody/Request for Analysis Form

7.5 Radiological Survey Form

8.0 REFERENCES

8.1 Requirements and Specifications

U.S. Department of Energy, Nevada Operations Office, July 1993, "Sampling and Analysis Plan," *Project Chariot: 1962 Tracer Study Site Assessment and Remedial Action Plan*, Appendix A, DOE/NV/93-085, Las Vegas, Nevada.

8.2 Related Procedures

8.2.1 SOP-CHR-01, Sample Control and Documentation

8.2.2 SOP-CHR-02, General Field Instructions

8.2.3 SOP-CHR-04, Field Decontamination

8.2.4 SOP-CHR-06, Field Activity Photographs

8.2.5 SOP-CHR-09, Shipment of Samples

8.3 Other

None

9.0 ATTACHMENTS

Attachment A - Sediment Sampling Supplies and Equipment Checklist

ATTACHMENT A

SEDIMENT SAMPLING SUPPLIES AND EQUIPMENT LIST
(Page 1 of 1)

- Ziploc® bags (gallon size)
- Clear packing tape
- Shipping forms/express shipping forms/radiation transportation labels, if applicable
- Flashlight/extra batteries
- 35mm camera
- Compass (Brunton or orienteering type)
- Fiberglass measuring tape (100 foot)
- Pin flags, surveyors tape, stakes
- Hammer (5-pound sledge)
- 1,000 milliliter sample containers/precleaned; and labels
- Wildco Hand Core Sediment Sampler
- Replacement liner tubes (20-in. length clear plastic)
- Replacement eggshell catchers (2-in. diameter)
- Replacement nosepieces (2-in. diameter)
- Core Sample Removal Tool
- Altimeter
- USGS 15-minute topographic maps of area
- Sample Collection Logs
- Field Activity Daily Logs
- Chain-of-Custody/Request-for-Analysis Forms
- Durable coolers
- Packing materials
- Pen (black waterproof ink)
- Custody tape
- Nitrile or equivalent gloves (PVC surgical)
- Labels
- Stainless steel spoons/trowel
- Hand corer extension tube
- Global Positioning System

This page intentionally left blank

INTERNATIONAL
TECHNOLOGY
CORPORATION

ITLV

STANDARD OPERATING PROCEDURE

NUMBER: CHR-08

TITLE: **Surface Water Sampling**

APPROVED: [signature] **DATE:** 7/9/93
ITLV Program Manager

APPROVED: [signature] **DATE:** 7-9-93
ITLV Project Manager

APPROVED: [signature] **DATE:** 7-9-93
ITLV Quality Assurance Officer

CONTROLLED COPY NO. : _____

Revision No.	**Date**

TABLE OF CONTENTS

1.0 SCOPE AND OBJECTIVE

1.1 Scope - This procedure applies to the surface-water sampling from site-related waterbodies to determine if residual radionuclide tracers are present. To reduce errors introduced by field techniques, collection of surface-water samples will be done in a consistent manner and use chemically inert sampling material.

1.2 Objective - The objective of this procedure is to establish a standard method for the collection of surface water that will provide representative samples of the actual site conditions.

2.0 DEFINITIONS

2.1 Flow Meter - an electronic field instrument designed to measure depth and instantaneous velocity in a flowing body of water.

2.2 Horiba U-10 Water Quality Checker - an electronic field instrument designed to measure pH, conductivity, turbidity, dissolved oxygen, temperature and salinity.

2.3 May - The word may is used to denote permissibility.

2.4 Shall - The word shall denotes a requirement.

2.5 Should - The word should is used when an element is recommended.

2.6 Water Quality Parameters - in-situ measurements taken of a body of water such as pH, turbidity, conductivity, temperature, dissolved oxygen and salinity that may be used to indicate the existing physical water quality of the measured data.

3.0 RESPONSIBILITIES AND QUALIFICATIONS

3.1 IT Project Manager - The IT Project Manager is responsible for assuring the implementation of this procedure during the performance of project activities.

3.2 Sampling and Analysis Supervisor (SAS) - The SAS is responsible for the implementation of this procedure. The SAS shall select qualified personnel to perform this activity.

3.3 Quality Assurance Officer - The Quality Assurance Officer is responsible for approving this procedure and performing surveillances to verify compliance with this procedure.

3.4 Field Personnel - Field personnel are responsible for meeting the requirements of this procedure and the Site-Specific Health and Safety Plan (SSHASP).

4.0 MATERIALS/EQUIPMENT AND CALIBRATION REQUIRED

For a complete list of required materials and equipment, see Attachment A.

5.0 METHOD

5.1 Preparation

5.1.1 Field Office

5.1.1.1 Review the SOPs listed in Section 8.0, and the SSHASP.

5.1.1.2 Coordinate schedules/actions with the field staff.

5.1.1.3 Assemble the equipment and supplies listed in Attachment A. Verify the proper operation of all sampling equipment.

5.1.1.4 Notify the laboratory of sample types, the number of samples, and the approximate arrival date.

5.1.1.5 Contact the carrier that will transport samples to obtain information on regulations and specifications.

5.1.2 Documentation

5.1.2.1 Obtain and complete a Field Activity Daily Log (FADL) (see SOP-CHR-01, Sample Control and Documentation).

5.1.2.2 Obtain a sufficient number of the appropriate data collection forms (i.e., Sample Collection Logs, and Chain-of-Custody/Request for Analysis [COC/RFA] Forms). (See SOP-CHR-01, Sample Control and Documentation).

5.1.3 Field

Field preparation requires organizing sample containers, sample labels, and documentation in an orderly manner that promotes consistency and traceability of all data.

(Note: All sampling shall be performed starting with the furthest downstream location and working towards the most upstream location).

5.1.3.1 Before sampling, ensure that all sampling equipment is clean by rinsing the 600 milliliter beaker in the surface water three times prior to collecting the sample.

5.1.3.2 Record all pertinent information (date, site name, ID number, and location) on the FADL and the appropriate data forms. Note field conditions, unusual circumstances, and weather conditions.

5.1.3.3 At each surface water station prior to sampling and flow measurements, take water quality parameters in accordance with the Horiba U-10 Water Quality Checker SOP (CHR-29) and record all data on FADLs.

5.1.3.4 Select a transect on the stream; determine total width across the transect. At selected intervals along the transect, measure depth and velocity using a flow meter. Record all data on FADLs.

5.2 Verifying and Marking Sample Stations

5.2.1 All landmarks must be permanent or securely fixed in place.

5.2.2 At least two landmarks are preferred so that station locations can be reproduced by triangulation.

5.2.3 Record brief descriptions of station locations, including relevant landmarks on the FADL.

5.2.4 Sketch the sample location with detailed information on the Sample Collection Log.

5.2.5 Photograph the sampling station and include landmarks.

5.3 Collecting Surface-Water Samples

5.3.1 During the surface water sampling effort, record the following information on the Sample Collection Log: sample locations; split/duplicate interval; date/time of sample collection; sampler's name, any unusual occurrences (visual and/or physical); field conditions (weather, temperature, etc.); all field survey radiation measurements recorded by the Health and Safety Officer (HSO) or designee; and work progress. (Surface-water sample locations will coincide with stream sediment sample locations).

Note: All safety equipment and action-levels are specified by the HSO and are referenced in the SSHASP.

5.3.2 Collect samples by hand in the creek at mid-channel, mid-depth.

5.3.3 Handle all media with nitrile gloves or equivalent (PVC surgical).

5.3.4 Take care to avoid including bottom sediment from near bottom samples. Approach stations from downcurrent, with consideration for wind direction.

5.3.5 If beakers are used, rinse disposable beaker three times in the surface water before collecting sample. Transfer the sample into the appropriate sample containers (1,000 milliliter sample container, preserved with HNO_3, supplied by the lab). Alternately, a grab sample may be collected. Care will be taken not to overfill the sample container and spill the preservative. After the sample has been collected, ensure that the sample is preserved to the correct pH (less than 2) and document the pH level on the COC/RFA Form.

5.3.6 If needed, preservation may completed at the basecamp to avoid the potential for an accidental spill of the preservative (2 milliliters of 16 molar nitric acid per liter of sample).

5.3.7 Wipe off the outside of the sample container and complete sample container label with all appropriate information (see SOP-CHR-07, Sediment Sampling).

5.3.8 Secure the sample container label by applying clear plastic tape over the label (after ascertaining that the correct information has been transferred to the label) to avoid potential damage to the label or obliteration of information. If additional preservative is not needed, place an IT custody seal over the container lid. (Note: steps 5.3.7 and 5.3.8 may be performed prior to sample collection.)

5.3.9 The HSO or designee will survey the sample container and record the measurement on the COC/RFA Form and the Radiological Survey Form (Attachment B).

5.3.10 Place the sample container into a one gallon-size Ziploc® bag and seal.

5.3.11 Record all the applicable information regarding the sample (type, location, date, sampler's name, analysis requested, etc.) on the Sample Collection Log.

5.3.12 Complete the COC/RFA Form(s).

5.3.13 Maintain custody of the samples by keeping the samples in actual possession, within view, locked up or sealed to prevent tampering, or placed in a secure area restricted to authorized personnel. SOP-CHR-01, Sample Control and Documentation, and SOP-CHR-09, Shipment of Samples, shall be followed for sample handling.

5.4 Post Operation

5.4.1 Field

5.4.1.1 Verify that all equipment is accounted for, and decontaminated (see SOP-CHR-04, Field Decontamination).

5.4.1.2 Make sure all sampling locations are properly marked and the location is readily visible on the location marker.

5.4.2 Documentation

5.4.2.1 Record on the FADL those locations where sampling was performed.

5.4.2.2 Complete daily log entries, verify the accuracy of entries, and sign and date all pages.

5.4.2.3 Document the chain-of-custody on the COC/RFA Form.

5.4.2.4 Review data collection forms for completeness.

5.4.3 Field Office

5.4.3.1 Deliver original forms and FADLs to the IT Project Manager for technical review. The Project Manager shall review and sign the forms, as appropriate, and submit them to the project central files at the completion of the project.

5.4.3.2 Inventory equipment and supplies. Repair or replace all broken or damaged equipment. Replace expendable items. Return equipment to the equipment manager and report incidents of malfunction or damage.

5.4.3.3 Contact the laboratory to verify that samples arrived safely and instructions for sample analyses are clearly understood.

5.5 Quality Control

5.5.1 Quality Control Samples shall be prepared at the time of surface water collection.

5.5.2 The quality control sampling program to be followed is described in the Sampling and Analysis Plan and Quality Assurance Project Plan.

5.5.3 Duplicate samples shall be collected at a frequency of one for every 20 samples, or one per batch.

5.6 Modifications to the Field Sampling Plan - All modifications of the project-specific documents must be in writing and appended to the document.

6.0 REQUIRED INSPECTION/ACCEPTANCE CRITERIA

Sample collection containers shall be inspected for integrity, correct material composition, the correct preservative, and correct amount required for the analyses to be performed.

7.0 RECORDS

The following records, generated as a result of implementation of this procedure, shall be retained as quality records in accordance with DOE Order 1324.2A, Record Disposition and IT QA Program requirements.

7.1 Field Activity Daily Log

7.2 Sample Collection Log

7.3 Ongoing sampling activities at stations are to be photo-documented

7.4 Chain-of-Custody/Request for Analysis Form

7.5 Radiological Survey Form

8.0 REFERENCES

8.1 Requirements and Specifications

U.S. Department of Energy, Nevada Operations Office, July 1993, "Sampling and Analysis Plan," *Project Chariot: 1962 Tracer Study Site Assessment and Remedial Action Plan*, Appendix A, DOE/NV/93-085, Las Vegas, Nevada.

8.2 Related Procedures

8.2.1 SOP-CHR-01, Sample Control and Documentation

8.2.2 SOP-CHR-02, General Field Instructions

8.2.3 SOP-CHR-04, Field Decontamination

8.2.4 SOP-CHR-06, Field Activity Photographs

8.2.5 SOP-CHR-09, Shipment of Samples

8.2.6 SOP-CHR-29, Horiba U-10 Water Quality Checker

8.3 Other

None

9.0 ATTACHMENTS

9.1 Attachment A - Surface Water Sampling Supplies and Equipment List

9.2 Attachment B - Radiological Survey Form

ATTACHMENT A

SURFACE WATER SAMPLING SUPPLIES AND EQUIPMENT LIST
(Page 1 of 1)

- Ziploc® bags (gallon size)
- Clear packing tape
- Bound field notebook
- Shipping forms/Federal Express/radiation transportation labels
- Flashlight/extra batteries
- 35 mm camera
- Compass (Brunton or orienting type)
- 100-foot fiberglass measuring tape
- Pin flags, surveyors tape, stakes
- Hammer (5-pound sledge)
- Maker pens, pencils
- Sample Collection Logs
- 1,000 milliliter sample containers with preservatives (HNO_3, H_2SO_4)
- Plastic bucket (5 gallon)
- Sample labels
- Field Activity Daily Logs
- Chain-of-Custody/Request for Analysis Forms
- Clear plastic disposable beakers
- Altimeter
- USGS 15 minute topographic maps of the area
- Coolers
- Packing materials
- Custody tape
- Nitrile or equivalent gloves (PVC surgical)
- 2-milliliter 16 molar HNO_3 ampules
- Radiological Survey Forms
- Distilled or deionized water

ATTACHMENT B

RADIOLOGICAL SURVEY FORM
(Page 1 of 2)

INTERNATIONAL TECHNOLOGY CORPORATION

RADIOLOGICAL SURVEY

Page ___ of ___

MONITORING DATA				
Item or Personnel Name*	Survey Extent	Instrument	Reading	Remarks
		1 2 3 4		
		1 2 3 4		
		1 2 3 4		
		1 2 3 4		
		1 2 3 4		
		1 2 3 4		
		1 2 3 4		
		1 2 3 4		
		1 2 3 4		
		1 2 3 4		
		1 2 3 4		
		1 2 3 4		
		1 2 3 4		
		1 2 3 4		
		1 2 3 4		
		1 2 3 4		
		1 2 3 4		
		1 2 3 4		
		1 2 3 4		
		1 2 3 4		
		1 2 3 4		
		1 2 3 4		
		1 2 3 4		
		1 2 3 4		
		1 2 3 4		
		1 2 3 4		
		1 2 3 4		
		1 2 3 4		
		1 2 3 4		
		1 2 3 4		

*Lastname, Firstname MI.

ATTACHMENT B

RADIOLOGICAL SURVEY FORM
(Page 2 of 2)

INTERNATIONAL
TECHNOLOGY
CORPORATION

RADIOLOGICAL SURVEY

Page ___ of ___

Project Name: ________________ Survey Date: ________________

Project No.: ________________ Drawings Attached: Yes ☐ No ☐

Surveyed By: ________________ (Print Name) ________________ (Signature)

Reviewed By: ________________ (Print Name) ________________ (Signature)

INSTRUMENT DATA

Item	Instrument 1	Instrument 2	Instrument 3	Instrument 4
Instrument Model No.				
Instrument Serial No.				
Detector Model No.				
Detector Serial No.				
Calibration Due Date				
Parameter Measured (α, β, γ, etc.)				
Parameter Units (cpm, mR/hr, etc.)				
Instrument Efficiency (%)				
Background Reading				

DAILY EFFICIENCY CHECK

Item	Instrument 1	Instrument 2	Instrument 3	Instrument 4
Radioactive Source ID				
Source Activity (dpm)				
Initial Instrument Reading (cpm)				
Initial Instrument Reading (dpm)				
Lower Limit (dpm) [0.8 x Source Activity]				
Upper Limit (dpm) [1.2 x Source Activity]				
Final Instrument Reading (cpm)				

Calibration Technician: ________________ (Print Name) ________________ (Signature)

INTERNATIONAL
TECHNOLOGY
CORPORATION

ITLV

STANDARD OPERATING PROCEDURE

NUMBER: CHR-09

TITLE: **Shipment of Samples**

APPROVED: ____________________ **DATE:** 7/9/93
ITLV Program Manager

APPROVED: ____________________ **DATE:** 7-9-93
ITLV Project Manager

APPROVED: ____________________ **DATE:** 7-9-93
ITLV Quality Assurance Officer

CONTROLLED COPY NO. : _____

Revision No.	**Date**

TABLE OF CONTENTS

1.0 SCOPE AND OBJECTIVE

1.1 Scope - This procedure applies to all samples collected by IT Corporation and shipped to an off-site lab.

1.2 Objective - This procedure provides the methods to be used for sample handling, packaging, shipping.

2.0 DEFINITIONS

2.1 Carrier - A person or firm engaged in the transportation of passengers or property.

2.2 Custodian - The person responsible for the custody of samples at a particular time, until custody is transferred to another person (and so documented), who then becomes custodian. A sample is under your custody if:

- You possess the sample
- It is in your view, after being in your physical possession
- It was in your physical possession but is now in a secured area to prevent tampering
- You have designated and identified a secure area, restricted to authorized personnel only, to store the sample.

2.3 Environmental Sample - Low concentration sample typically collected off site and not requiring U.S. Department of Transportation (DOT) or International Air Transport Association (IATA) labelling as a hazardous sample.

2.4 Packaging - The assembly of one or more containers and any other components necessary to assure compliance with the minimum packaging requirements of 49 C.F.R. 172, and IATA, Chapter 4 (List of Dangerous Goods) including containers.

2.5 Sample - A sample is physical evidence collected from a facility or the environment, which is representative of conditions at the point and time that it was collected.

3.0 RESPONSIBILITIES AND QUALIFICATIONS

3.1 IT Project Manager - The IT Project Manager is responsible for assuring the implementation of this procedure during the performance of project activities.

3.2 Sampling and Analysis Supervisor (SAS) - The SAS is responsible for ensuring that this activity is performed in accordance with the requirements established in this procedure. The SAS shall select qualified personnel to perform this activity.

3.3 Quality Assurance Officer - The Quality Assurance Officer is responsible for performing surveillances to verify compliance to this procedure.

3.4 Field Personnel - Field personnel are responsible for meeting the requirements of this procedure and the Site-Specific Health and Safety Plan (SSHASP).

4.0 MATERIALS/EQUIPMENT AND CALIBRATION REQUIRED

4.1 Materials/Equipment

- Airbill (Federal Express)
- Sample bottles with required preservatives added
- Shipper containers (coolers)
- Sample labels
- Custody tape
- Strapping tape or equivalent
- Packing materials
- Ziploc® bags
- Additional preservatives (HNO_3)
- Polyethylene (garbage) bags
- Chain-of-Custody/Request for Analysis (COC/RFA) Forms
- Blue Ice®
- Ludlum Model 2929
- Ludlum micro-R meter
- Alpha/Beta/Gamma Scintillator 43-5

4.2 Calibration Requirements

4.2.1 Ludlum micro-R meter or equivalent-instrument shall be calibrated every six months.

4.2.2 Ludlum model 2929 dual channel scaler with alpha/beta/gamma/scintillator 43-5-instrument shall be calibrated every six months.

4.2.3 Daily efficiency checks shall be performed as a minimum at beginning and end of each shift and as determined appropriate by the SAS for all instruments.

5.0 METHODS

5.1 Sample Packaging and Shipping

5.1.1 Select appropriate sample shipping containers to hold the samples during shipment.

5.1.2 Tape the drain plug if applicable, on the inside and outside of the shipping container.

5.1.3 Line the shipping container with a large polyethylene (garbage) bag.

5.1.4 Place several inches of packing material at the bottom of the shipping container.

5.1.5 Place sample containers in shipping container, and place packing material around sample containers so that samples will not come in contact with each other during transit.

5.1.6 Place appropriate amounts of ice packaged in baggies, or frozen Blue Ice®, to assure the maintenance of the proper temperature during shipping. Place samples for volatile organic analysis closest to the ice. Attempt to maintain the samples at a cool temperature with ice sealed in plastic bags or blue ice.

5.1.7 Place packing material on top of the sample containers to assure no movement of the sample containers.

5.1.8 Place the completed COC/RFA forms in a plastic bag and tape to the inside top of the shipping container.

5.1.9 Use strapping tape or equivalent to secure both ends of the shipping container during shipment.

5.1.10 Attach labels with arrows drawn to indicate the upright position on all four sides of the shipping container including "this end up" on the lid. Place address label on the lid outside of shipping container.

5.1.11 Place custody seal across shipping container cover on opposite ends and initial and date.

5.1.12 Affix proper carrier shipping papers.

5.2 <u>Sample Shipping</u>

5.2.1 Determine activity of the sample(s). If less than 2,000 picocuries per gram (pCi/g) no special controls are required and samples can be shipped as environmental simples. Check to see if the substance is forbidden on aircraft. Section 1 of the International Air Transport Association (IATA) regulations for dangerous goods contains a list of the substances that cannot be transported by air.

5.2.2 If samples exhibit activity greater than 2,000 pCi/g, determine the proper shipping classification.

5.2.3 All samples must be transported by cargo aircraft or land transport.

5.2.4 Prepare the consignment according to relevant requirements.

5.2.5 Ensure that all appropriate markings are printed on the packages and labels are attached.

5.2.6 Make any appropriate advance arrangements with the carrier and obtain current information about regulations and specifications that might affect the shipment, if applicable.

5.2.7 Prepare the cargo airbill, complete, and sign the appropriate declarations for transporting dangerous goods, if applicable.

5.2.8 Deliver the shipment to the local office of the freight carrier or arrange for a pickup at the site.

5.2.9 The copy of the bill of lading form will be retained as evidence of date of shipping, sender and destination.

5.3 <u>Sample Control</u>

5.3.1 Notify the analytical laboratory of sample types, the number of samples, and the approximate arrival date. Request sample containers based on sample types, and analytical parameters.

5.3.2 Verify that all sample bottles have been correctly identified and labels have all necessary information (location, time, date, etc.)

5.3.3 Assemble the equipment and supplies listed in Section 4.1.

5.3.4 After samples have been collected, cross-check filled sample bottles in possession against those recorded in the on the COC/RFA form. Maintain custody of filled sample bottles by keeping them in actual possession, within view, locked or sealed up to prevent tampering, or bringing them into a secure area.

5.3.5 In general, analyze samples as soon as possible after collection. Holding times are listed in the Sampling and Analysis Plan (SAP). Samples should be delivered to the laboratory as soon as possible to avoid nonconformances with holding time.

5.3.6 After the completion of field work, deliver original forms to the site manager for review and filing.

6.0 REQUIRED INSPECTIONS/ACCEPTANCE CRITERIA

Samples shall be inspected by the shipping coordinator to verify that: sample containers are properly labelled, properly packed in the shipping container, paperwork is completed, and external labelling is adequate.

7.0 RECORDS

The following records generated as a result of implementation of this procedure shall be retained as quality records in accordance with DOE Order 1324.2A, Record Disposition and IT QA Program requirements.

7.1 Bill of Lading

8.0 REFERENCES

8.1 Requirements and Specifications

8.1.1 U.S. Department of Energy, Nevada Operations Office, July 1993, "Quality Assurance Project Plan," *Project Chariot: 1962 Tracer Study Site Assessment and Remedial Action Plan*, Appendix A, DOE/NV/93-085, Las Vegas, Nevada.

8.1.2 International Air Transport Association (IATA), 1991, "Dangerous Goods Regulations," Montreal, Quebec, Canada.

8.1.3 U.S. Department of Transportation, 1985, code of Federal Regulations, Title 49, Parts 100-199, U.S. Government Printing Office, Washington, D.C.

8.2 Related Procedures

None

8.3 Other

None

9.0 ATTACHMENTS

None

This page intentionally left blank

INTERNATIONAL
TECHNOLOGY
CORPORATION

ITLV

STANDARD OPERATING PROCEDURE

NUMBER: CHR-10

TITLE: **Surface Soil Sampling**

APPROVED: ______________________ **DATE:** 7/9/93
ITLV Program Manager

APPROVED: ______________________ **DATE:** 7-9-93
ITLV Project Manager

APPROVED: ______________________ **DATE:** 7-9-93
ITLV Quality Assurance Officer

CONTROLLED COPY NO. : _____

Revision No.	**Date**

TABLE OF CONTENTS

1.0 SCOPE AND OBJECTIVES

1.1 Scope - This procedure describes required methods for collecting soil samples from the surface and the shallow surface to determine if residual radionuclide tracers are present. To reduce error introduced by field techniques, collection of soil samples will be done in a consistent manner and use chemically inert sampling materials.

1.2 Objective - The objective of this procedure is to establish a standard method for the collection of soil that will provide representative samples of actual site conditions.

2.0 DEFINITIONS

2.1 May - The word may is used to denote permissibility.

2.2 Shall - The word shall denotes a requirement.

2.3 Should - The word should is used when an element is recommended.

3.0 RESPONSIBILITIES AND QUALIFICATIONS

3.1 IT Project Manager - The IT Project Manager is responsible for assuring the implementation of this procedure during the performance of project activities.

3.2 Sampling and Analysis Supervisor (SAS) - The SAS is responsible for the implementation of this procedure. The SAS shall select qualified personnel to perform this activity.

3.3 Quality Assurance Officer - The Quality Assurance Officer is responsible for approving this procedure and performing surveillance to verify compliance with this procedure.

3.4 Field Personnel - Field personnel are responsible for meeting the requirements of this procedure and the Site-Specific Health and Safety Plan (SSHASP).

3.5 Site Health Physicist - The Site Health Physicist is responsible for meeting the responsibilities of this procedure.

4.0 MATERIALS/EQUIPMENT AND CALIBRATION REQUIRED

For complete list of required materials and equipment, see Attachment A.

5.0 METHOD

5.1 Preparation

5.1.1 Field Office

5.1.1.1 Review the SOPs listed in Section 8.0 and the SSHASP.

5.1.1.2 Coordinate schedules/actions with the field staff.

5.1.1.3 Assemble the equipment and supplies listed in Attachment A. Verify the proper operation of all sampling equipment.

5.1.1.4 Notify the laboratory of sample types, the number of samples, and the approximate arrival date.

5.1.1.5 Contact the carrier that will transport samples to obtain information on regulations and specifications. Shipment of Samples shall be performed in accordance with SOP-CHR-02 and SOP-CHR-09.

5.1.2 Documentation

5.1.2.1 Obtain and complete a Field Activity Daily Log (FADL) (see SOP-CHR-01, Sample Control and Documentation).

5.1.2.2 Obtain a sufficient number of the appropriate data collection forms (i.e., Sample Collection Logs, and Chain-of-Custody/Request for Analysis [COC/RFA] Forms [see SOP-CHR-01]).

5.1.3 Field

Field preparation requires organizing sample containers, sample labels, and documentation in an orderly, systematic manner that promotes consistency and traceability of all data.

5.1.3.1 Before sampling, verify that all sampling equipment is pre-cleaned.

5.1.3.2 Record all pertinent information (date, site name, ID number, and location) on the FADL and the appropriate forms. Note field conditions, unusual circumstances, and weather conditions.

5.1.3.3 Assign each sample a number which is unique to the sample. The numbering system should guarantee that there will be no duplication of sample numbers either during the project or in subsequent or preceding projects. Sample number assignments are provided in the Sampling and Analysis Plan (SAP).

5.1.3.4 For background soil samples and "clean" closure samples, lay out the grid system following the instructions located in the SAP.

5.2 Soil Sample Collection

5.2.1 The sampling team shall consist of two members. One person (the sampler) shall handle the soil sampling tool while the other person (the notekeeper) shall handle the sample containers.

5.2.2 Disposable latex or nitrile gloves shall be worn while collecting and handling the samples. The sampler and notekeeper shall wear clean gloves for each sample.

5.2.3 Locate the designated point to be sampled.

5.2.4 Begin field work. Periodically update the FADL to indicate the location sampled, the unique sample number, and other relevant information.

5.2.5 The sampler shall remove any existing vegetation from the sample location. Then, place a sheet of polyethylene (or plastic garbage bag) at the sample location to prevent the soil sampling tool from coming in direct contact with the ground.

5.2.6 At each sample location, two soil samples shall be taken, at the following depth increments:

- First sample - 0 to 2 inches deep
- Second sample - 2 to 4 inches deep.

5.2.7 At the sample location, the sampler shall take the soil sample by pushing the soil sampling tool (hand trowel or hand auger) vertically into the soil to the depths specified in Step 5.2.6.

5.2.8 If the sample is not a QA sample, proceed to Step 5.2.9. If the sample is to be a QA duplicate or triplicate, two or three adjacent cores must be taken to provide sufficient sample quantity for analysis.

5.2.9 The sampler shall remove the soil sampling tool from the soil.

5.2.10 Extract the soil sample into a clean plastic Ziploc® bag for a non-QA sample, or a clean stainless-steel bowl for a QA sample.

5.2.11 For a non-QA sample, proceed to Step 5.2.15. If the sample is a QA sample, the sampler shall reuse the same soil sampling instrument. Repeat Steps 5.2.7 through 5.2.11 once more for a QA duplicate, or twice for a QA triplicate.

5.2.12 After the appropriate number of cores have been composited, the notekeeper shall mix the composite sample thoroughly using a stainless-steel knife or spoon, removing large rocks or debris.

5.2.13 For a QA duplicate, the sampler shall split the sample into two plastic Ziploc® bags; for a QA triplicate into three plastic Ziploc® bags. A minimum of 600 grams should be collected per sample. Repeat Steps 5.2.7 through 5.2.20 for each sample bag.

5.2.14 The notekeeper shall close the plastic Ziploc® bag.

5.2.15 Place the plastic Ziploc® bag into another Ziploc® bag. Attach custody tape over the Ziploc® length of the bag, fold over and seal.

5.2.16 Complete a sample label and attach it to the outer bag. Secure the sample container label by applying clear packing tape over the label (after ascertaining that the correct information has been transferred to the label) to avoid potential damage to the label information. The following information shall be recorded on the sample label (see SOP-CHR-01):

- Sample number
- Project name and number
- Sampling location
- Sampling date and time
- Sampler's name (or initials)
- Sample type (composite or grab).

(Note: Sample labels may be prepared in advance and attached to the Ziploc® bags).

5.2.17 Clean the soil sampling tool according to SOP-CHR-04. Place the used gloves into a plastic bag for disposal.

5.2.18 Complete the Sample Collection Log. The Sample Collection Log will be prenumbered with unique sample numbers. One sample number shall be assigned to each sample. Record field observations on the FADL along with pertinent information from the Sample Collection Log.

5.2.19 The Site Health Physicist or his designee will survey each sample with a radiation survey meter and record the measurement.

5.2.20 Complete the COC/RFA Form.

5.2.21 Custody of the samples will be maintained by keeping the samples in actual possession, within view, locked or sealed to prevent tampering, or placed in a secure area restricted to authorized personnel.

5.2.22 Photo documentation of all sampling activities will follow the procedures in SOP-CHR-06, Field Activity Photographs.

5.3 <u>Post Operation</u>

5.3.1 <u>Field</u>

5.3.1.1 Verify that all equipment is accounted for, and decontaminated (see SOP-CHR-04, Field Decontamination).

5.3.1.2 Restore the site to pre-sampling conditions.

5.3.1.3 Make sure all sampling locations are properly marked and the location ID is readily visible on the location marker.

5.3.2 <u>Documentation</u>

5.3.2.1 Record on the FADL those locations where sampling was performed.

5.3.2.2 Complete daily log entries, verify the accuracy of entries, and sign and date all pages.

5.3.2.3 Document the chain-of-custody on the COC/RFA Form.

5.3.2.4 Review data collection forms for completeness.

5.3.3 Field Office

5.3.3.1 Deliver original forms and FADLs to the IT Project Manager for technical review. The Project Manager shall review and sign the forms, as appropriate, and submit them to the project central files at the completion of the project.

5.3.3.2 Inventory equipment and supplies. Repair or replace all broken or damaged equipment. Replace expendable items. Return equipment to the equipment manager and report incidents of malfunction or damage.

5.3.3.3 Contact the laboratory to verify that samples arrived safely and instructions for sample analyses are clearly understood.

5.4 Quality Control

5.4.1 Quality control samples shall be prepared at the time of surface soil collection.

5.4.2 The quality control sampling program to be followed is described in the Project-Specific Sampling and Analysis Plan and Quality Assurance Project Plan.

5.4.3 Duplicate samples shall be collected at a frequency of one for every 20 samples, or one per batch.

5.5 Modifications to the Field Sampling Plan - All modifications of the project-specific documents must be in writing and appended to the document.

6.0 REQUIRED INSPECTION/ACCEPTANCE CRITERIA

Sample collection containers shall be inspected for integrity, correct material composition and the correct amount required for the analyses to be performed.

7.0 RECORDS

The following records, generated as a result of implementation of this procedure, shall be retained as quality records in accordance with DOE Order 1324.2A, Record Disposition and IT QA Program requirements.

7.1 Field Activity Daily Log

7.2 Sample Collection Log

7.3 Chain-of-Custody/Request for Analysis Form

7.4 Radiological Survey Form, as per SOP-CHR-08, Surface Water Sampling

8.0 REFERENCES

8.1 Requirements and Specifications

8.1.1 ASTM C998-83, Standard Method for Sampling Surface Soil for Radionuclides.

8.2 Related Procedures

8.2.1 SOP-CHR-01, Sample Control and Documentation

8.2.2 SOP-CHR-02, General Field Instructions

8.2.3 SOP-CHR-04, Field Decontamination

8.2.4 SOP-CHR-06, Field Activity Photographs

8.2.5 SOP-CHR-08, Surface Water Sampling

8.2.6 SOP-CHR-09, Shipment of Samples

8.3 Other

None

9.0 ATTACHMENTS

9.1 Attachment A - Surface Soil Sampling Supplies and Equipment List

ATTACHMENT A

SURFACE SOIL SAMPLING SUPPLIES AND EQUIPMENT LIST
(Page 1 of 1)

- Ziploc® bags (gallon-size)
- Packing tape
- Large plastic garbage bags
- Grass clippers
- Camera/film - 35mm
- Compass (Brunton or orienting type)
- 100-foot fiberglass measuring tape
- Pin flags, surveyors tape, stakes
- Stainless-steel mixing bowls (2-liter)
- Stainless-steel knives/spoons
- Marker pens, pencils (indelible)
- Sample Collection Logs
- Radiation survey meter
- Hand auger
- Ruler
- Field Activity Daily Logs
- Chain-of-Custody/Request for Analysis Form
- Hand trowels
- Nitrile gloves or equivalent (PVC surgical)
- Sample labels
- Coolers
- Packing materials
- GPS
- Maps

INTERNATIONAL
TECHNOLOGY
CORPORATION

ITLV

STANDARD OPERATING PROCEDURE

NUMBER: CHR-11

TITLE: **Exposure Rate Measurements Using a Pressurized Ion Chamber**

APPROVED: [signature] ITLV Program Manager **DATE:** 7/9/93

APPROVED: [signature] ITLV Project Manager **DATE:** 7-9-93

APPROVED: [signature] ITLV Quality Assurance Officer **DATE:** 7-9-93

CONTROLLED COPY NO. : ____

Revision No.	**Date**

TABLE OF CONTENTS

1.0 SCOPE AND OBJECTIVE

1.1 Scope - This procedure provides instructions for conducting exposure rate measurements using a pressurized ion chamber at the 1962 Tracer Study Test Plot Area of the Project Chariot Site.

1.2 Objective - The objective of this procedure is to provide instruction for uniform measurement techniques when using the Reuter-Stokes pressurized ion chamber (PIC) for determining external gamma-ray exposure rate at a height of 1 meter above the soil surface.

2.0 DEFINITIONS

2.1 Calibration - The check or correction of the accuracy of a measuring instrument to assume proper operational characteristics.

2.2 May - The word may is used to denote permissibility.

2.3 Reproducible Geometry - A spatial configuration of a radiation detection instrument, in relation to a radiation source, that is specified in sufficient detail to allow each source check performed to obtain comparable results.

2.4 Shall - The word shall denotes a requirement.

2.5 Should - The word should is used when an element is recommended.

3.0 RESPONSIBILITIES AND QUALIFICATIONS

3.1 IT Project Manager - The IT Project Manager is responsible for assuring the implementation of this procedure during the performance of project activities.

3.2 Sampling and Analysis Supervisor (SAS) - The SAS is responsible for the implementation of this procedure. The SAS shall select qualified personnel knowledgeable in the requirements of this procedure and experienced in the use of the Reuter-Stokes PIC.

3.3 Quality Assurance Officer - The Quality Assurance Officer is responsible for approving this procedure and performing surveillances to verify compliance with this procedure.

3.4 Field Personnel - Field personnel are responsible for meeting the requirements of this procedure and the Site-Specific Health and Safety Plan (SSHASP).

4.0 MATERIALS/EQUIPMENT AND CALIBRATION REQUIRED

4.1 Material/Equipment

- Tripod
- Reuter-Stokes PIC
- Stop watch
- Field Activity Daily Log (FADL)
- Reuter-Stokes PIC Operations Manual
- Jeweler's screwdriver

4.2 Calibration Required

4.2.1 The instrument being used shall be calibrated at least annually and have a current calibration certificate.

4.2.2 Any instrument exceeding the stated calibration expiration date shall not be used and shall be tagged "out of service".

4.2.3 Operational and source checks shall be performed and recorded before and after an instrument is used.

5.0 METHOD

5.1 Warnings

5.1.1 The sensor housing contains an ionization chamber with high internal pressure (300 pounds per square inch [psi]) and high voltage (300 volts of direct current [VDC]) on its surface. Removal of the chamber from its protective housing or mishandling, could cause serious injury.

5.1.2 The 300V lithium battery may explode or leak if recharged, disassembled or heated above 100°C (212°F). Do not short circuit.

5.2 Operational Check

5.2.1 Turn the power switch, located on the rear of the enclosure, to the "ZERO" position. Within 3 seconds the LCD should display the main menu.

5.2.2 Depress the CURRENT DATA key to measure the "ZERO" offset. This reading should be less than 1 μR/h. If not, the offset can be adjusted using the potentiometer located on the PIC.

5.2.3 The zero adjustment is located on a potentiometer mounted next to the chamber connector. If needed, this can be adjusted using a jewelers screwdriver.

5.3 Initial Setup

5.3.1 The initial setup (i.e., including date, time, operational parameters, and unit tests) shall be initially performed before entering the field as per instructions in the Reuter-Stokes Operational Manual.

5.3.2 Specific parameters to be set are the date and time, radiation units, operating mode and the radiation alarm unit.

5.4 Background Check

5.4.1 Turn the power switch to "ZERO." Adjust the offset if needed, or if not, wait 10 seconds then turn the switch to "READ."

5.4.2 From the main menu press the CURRENT DATA button.

5.4.3 Press the DATA STATS button and begin counting using the "Dose Integrator."

5.4.4 Follow the steps outlined in SOP-CHR-18, Daily Source and Background Checks, for determining and recording the background exposure rate.

5.5 Instrument Source Check

Repeat Steps 5.4.1 through 5.4.4 using a Cesium-137 (Cs-137) check source in a reproducible geometry.

5.6 Actual Gamma-Ray Exposure Measurement

5.6.1 Attach the sensor head to the tripod.

5.6.2 Adjust the height of the chamber so that it is 1 meter from the surface to be measured.

5.6.3 Follow Steps 5.4.1 through 5.4.3.

5.7 Calculations

5.7.1 $$\text{PIC reading } (\mu R/hr) = \frac{60 \text{ min/hr}}{\text{Count time in minutes}} \times \text{exposure recorded by PIC } (\mu R)$$

5.7.2 Net exposure rate reading = PIC reading (mR/hr) - PIC background reading (mR/hr.)

5.7.3 Average net exposure rate ($\bar{x}$):

$$\bar{x} = \frac{1}{n_s} \sum_{i=1}^{n_s} x_i$$

Where: n_s = the number of individual net count rate measurements used to determine x and s;

$\bar{x}$ = the calculated mean (average); and

x_i = the individual net exposure rate.

5.7.4 Standard deviation:

$$s = \sqrt{\frac{\sum_{i=1}^{n_s} (\bar{x}-x_i)^2}{n-1}}$$

Where: s = is the standard deviation.

6.0 REQUIRED INSPECTION/ACCEPTANCE CRITERIA

6.1 Calibration check measurements of radiation survey instruments must be within three standard deviations of the mean. If two consecutive measurements fall outside this limit, the instrument must be taken out of service until it is recalibrated.

6.2 All calculations must be checked by a person other than the originator prior to finalization and filing.

7.0 RECORDS

The following records, generated as a result of implementation of this procedure, shall be retained as quality records in accordance with DOE Order 1324.2A, Record Disposition and IT QA Program requirements.

7.1 Field Activities Daily Log

8.0 REFERENCES

8.1 Requirements and Specifications

8.1.1 American National Standards Institute, Report No. ANSI N323-1978, "Implementation Guide for Radiological Survey Procedures," 1992.

8.1.2 United States Department of Energy, "Draft - Environmental Implementation Guide for Radiological Survey Procedures," 1992.

8.1.3 Reuter-Stokes RSS-122 PIC Portable Environmental Radiation Monitor Operational Manual, January 1993.

8.1.4 National Council on Radiation Protection Report No. 50, Environmental Radiation Measurements.

8.1.5 U.S. Department of Energy, Nevada Operations Office, July 1993, *Project Chariot: 1962 Tracer Study Site Assessment and Remedial Action Plan*, DOE/NV/93-085, Las Vegas, Nevada.

8.2 Related Procedures

8.2.1 SOP-CHR-01, Sample Control and Documentation

8.2.2 SOP-CHR-17, Correlation of Sodium Iodide Readings with Pressurized Ion Chamber

8.2.3 SOP-CHR-18, Daily Source and Background Checks

8.3 Other

None

9.0 ATTACHMENTS

None

INTERNATIONAL
TECHNOLOGY
CORPORATION

ITLV

STANDARD OPERATING PROCEDURE

NUMBER: CHR-12

TITLE: **Visual Inspection and Documentation of Test Plots**

APPROVED: ______________________ **DATE:** 7/9/93
ITLV Program Manager

APPROVED: ______________________ **DATE:** 7-9-93
ITLV Project Manager

APPROVED: ______________________ **DATE:** 7-9-93
ITLV Quality Assurance Officer

CONTROLLED COPY NO. : _____

Revision No.	**Date**

TABLE OF CONTENTS

1.0 SCOPE AND OBJECTIVE

1.1 Scope - This procedure provides instructions for visual inspection and documentation of 1962 Tracer Study test plots at the Project Chariot Site.

1.2 Objective - To provide a repeatable, auditable procedure for establishing a grid system for referencing radiological survey activities.

2.0 DEFINITIONS

2.1 Grid - System of coordinates established on a site for purposes of referencing survey locations. Also known as Reference Grid System.

2.2 Grid Line Intersections - Grid points that include points where the grid lines intersect. Also known as nodes.

2.3 May - The word may is used to denote permissibility.

2.4 Shall - The word shall denotes a requirement.

2.5 Should - The word should is used when an element is recommended.

3.0 RESPONSIBILITIES AND QUALIFICATIONS

3.1 IT Project Manager - The IT Project Manager is responsible for assuring the implementation of this procedure during the performance of project activities.

3.2 Quality Assurance Officer - The Quality Assurance Officer is responsible for approving this procedure and performing surveillances to verify compliance with this procedure.

3.3 Sampling and Analysis Supervisor - The Sampling and Analysis Supervisor (SAS) shall determine grid requirements and supervise on-site gridding activities to assure compliance with requirements of this procedure. The SAS is responsible for the assignment of qualified personnel to these activities and for implementation of this procedure.

3.4 Field Personnel - Field personnel are responsible for meeting the requirements of this procedure and the Site-Specific Health and Safety Plan (SSHASP).

4.0 MATERIALS/EQUIPMENT AND CALIBRATION REQUIRED

4.1 Material/Equipment

- Transit/tripod
- Site pole
- Measuring Tape
- Grid markers (stakes, flags, flagging tape)
- Waterproof marker

4.2 Calibration Required

None

5.0 METHOD

5.1 Establish the grid system point of reference at the confluence of the Ogotoruk and Snowbank Creeks, using the global positioning system (GPS) and/or field surveying techniques.

5.2 Grid Dimensions

5.2.1 Starting at the point of reference, measure 100-foot (ft) intervals for the length of Snowbank Creek.

5.2.2 From the edge of Snowbank Creek, measure 70 ft on each side.

5.2.3 Establish grid blocks.

5.3 Open Land Grid System

5.3.1 Grid points shall be marked with stakes, flags, or survey tape, depending upon the characteristics of the surface.

5.3.2 The grid point of reference shall be identified as the reference for this grid system, and shall be identified on a grid marker with the GPS coordinates.

5.3.3 Coordinates of other grid points will be referenced to the initial starting point using alpha-numeric identifiers. The numeric identifier indicates the grid number, and the alphabetic identifier indicates the direction from the reference point (i.e., A [north], or B [south]).

5.3.4 Coordinates shall be identified for each grid line intersection with the GPS which may occur after the grid system has been surveyed.

5.3.5 Any location within a grid system may be designated by measuring the distance and direction from the point of interest to a grid point marker.

5.3.6 Attachment A contains a figure of the grid system.

5.4 Site Drawings

5.4.1 Prior to establishment of the grid system, a drawing shall be prepared by the survey team.

5.4.2 The drawing will indicate the grid, site boundaries, other pertinent site features, a reference compass direction, and a legend showing the scale.

5.5 Visual Inspection

5.5.1 In conjunction with the establishment of the grid system, a visual inspection will be conducted to potentially identify the original experimental test plots.

5.5.2 Based on documentation of experiment activities, the test plots were located along Snowbank Creek no further than 60 ft from the creek bank.

5.5.3 Potentially identified test plots or general areas that have been disturbed will be marked by placing staked flags in the center of the area.

5.5.4 These areas will be identified in the Field Activity Daily Log by referencing their location within the grid system.

5.5.5 Identified test plots will be radiologically surveyed, and soil samples will be collected from the area as described in SOPs CHR-10, Surface Soil Sampling, and CHR-13, Radiation Survey of Test Plots.

6.0 REQUIRED INSPECTION/ACCEPTANCE CRITERIA

Coordinates must be determined or verified by a State of Alaska licensed surveyor.

7.0 RECORDS

The following record, generated as a result of implementation of this procedure, shall be retained as a quality record in accordance with DOE Order 1324.2A, Record Disposition and IT QA Program requirements.

- Field Activity Daily Log

8.0 REFERENCES

8.1 Requirements and Specifications

U.S. Department of Energy, Nevada Operations Office, July 1993, *Project Chariot: 1962 Tracer Study Site Assessment and Remedial Action Plan*, DOE/NV/93-085, Las Vegas, Nevada.

8.2 Related Procedures

8.2.1 SOP-CHR-10, Surface Soil Sampling

8.2.2 SOP-CHR-13, Radiation Survey of Test Plots

8.3 Others

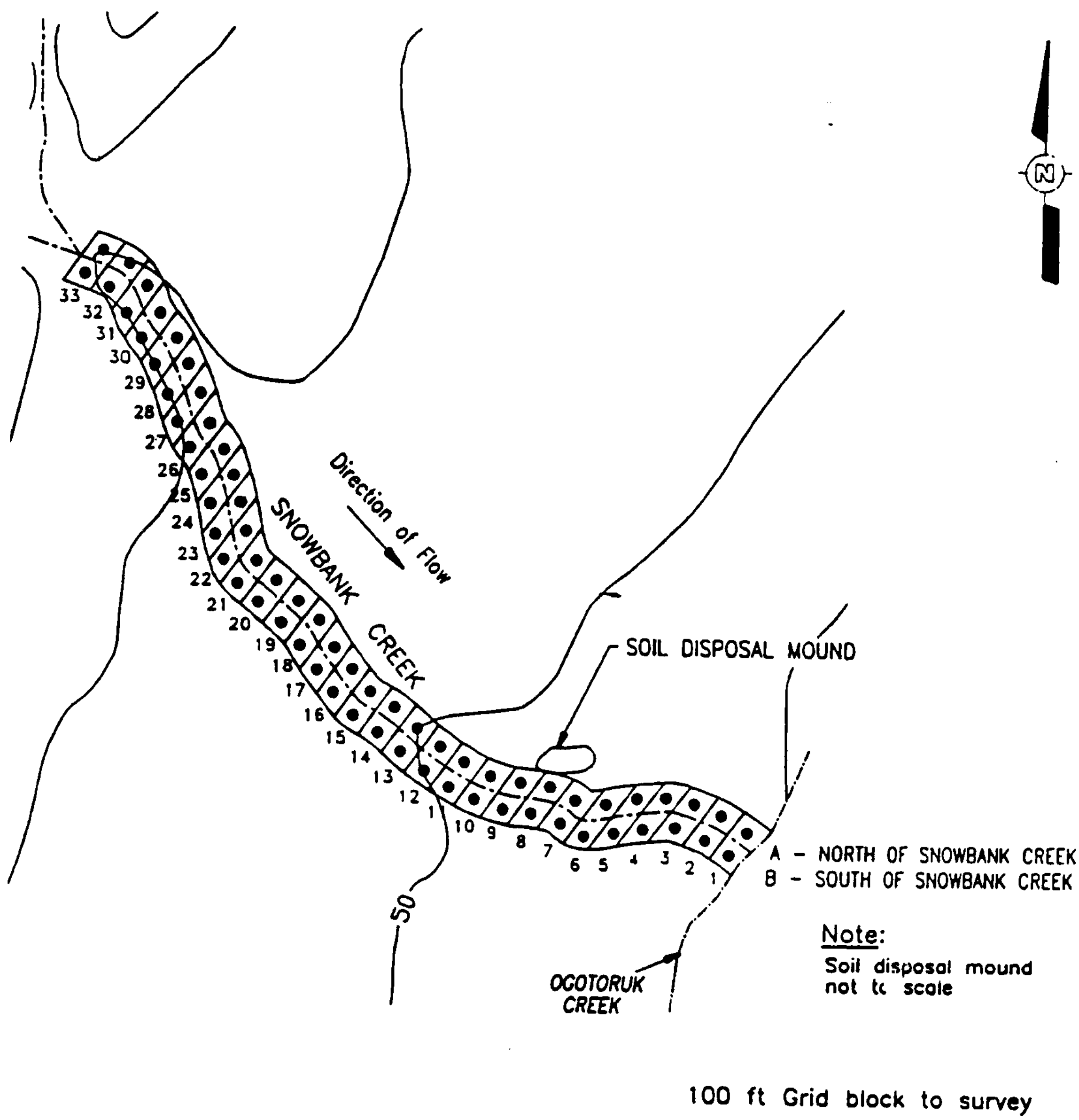
"A Guide for Environmental Radiation Surveillance at U. S. Department of Energy Installations", J. P. Corley, DOE/EP-0023, U.S. Department of Energy, 1981.

9.0 ATTACHMENTS

Attachment A - Example of Grid System

ATTACHMENT A

EXAMPLE OF GRID SYSTEM
(Page 1 of 1)



INTERNATIONAL
TECHNOLOGY
CORPORATION

ITLV

STANDARD OPERATING PROCEDURE

NUMBER: CHR-13

TITLE: **Radiation Survey of Test Plots**

APPROVED: ______________ **DATE:** 7/9/93
ITLV Program Manager

APPROVED: ______________ **DATE:** 7-9-93
ITLV Project Manager

APPROVED: ______________ **DATE:** 7-9-93
ITLV Quality Assurance Officer

CONTROLLED COPY NO. : _____

Revision No.	**Date**

TABLE OF CONTENTS

1.0 SCOPE AND OBJECTIVE

1.1 Scope - This procedure applies to the radiation survey of identified Project Chariot 1962 Tracer Study Test Plots.

1.2 Objective - The objective of this procedure is to provide a method for determining elevated levels of radioactivity in the soil of the test plots.

2.0 DEFINITIONS

2.1 Lower Limit of Detection (LLD) - The smallest amount of sample activity that will yield a net count for which there is confidence at a predetermined level that the activity measured is actually present.

2.2 May - The word may is used to denote permissibility.

2.3 Multichannel Analyzer (MCA) - A device that sorts out all of the output pulses from a detector according to the pulse height. Only pulses which fall within the energy range of a channel are recorded. An energy spectrum can be obtained by looking at the output of all channels.

2.4 Shall - The word shall denotes a requirement.

2.5 Should - The word should is used when an element is recommended.

2.6 Sodium Iodide (NaI) Detector - A scintillation crystal device which is very effective in the detection of gamma radiation.

3.0 RESPONSIBILITIES AND QUALIFICATIONS

3.1 IT Project Manager - The IT Project Manager is responsible for assuring the implementation of this procedure during the performance of project activities.

3.2 Quality Assurance Officer - The Quality Assurance Officer is responsible for approving this procedure and performing surveillances to verify compliance with this procedure.

3.3 Sampling and Analysis Supervisor (SAS) - The SAS is responsible for following this procedure and assuring that requirements are met. The SAS shall ensure that all personnel selected to perform this activity are qualified.

3.4 Field Personnel - Field personnel are responsible for meeting the requirements of this procedure and of the Site-Specific Health and Safety Plan (SSHASP).

4.0 MATERIALS/EQUIPMENT AND CALIBRATION REQUIRED

Materials/Equipment

- High Density Polyethylene (HDPE) sheeting
- NaI/ESP-2 detection system with associated equipment and attachments.
- Tripod
- Site maps
- Canberra Multichannel Analyzer (MCA), or equivalent
- Surface Measurement Field Logs
- Shovel
- Radiological Survey Logs
- Field Activity Daily Log (FADL)

5.0 METHOD

5.1 Survey entire plot area using a slow scan of 2 inches per second with the ESP-2 system. Record all readings above 95 percent LLD on the Surface Measurement Field Log (see SOP-CHR-03, Walk-over Surveys Using a Large Volume Scintillation Counter). Record all required information on the Radiological Survey Log (see SOP-CHR-03).

5.2 Set-up the MCA above the center of the plot area, or above the center of most contaminated region found in Step 5.1 above. Suspend the NaI detector 1 meter above plot using a tripod.

5.3 Obtain a 10 minute count.

5.4 Store spectrum on computer disk.

5.5 Analyze spectrum for Cs-137 using spectrum strip and log subtract.

5.6 Estimate Cs-137 concentration using SOP-CHR-14, Operation of Multichannel Analyzer.

5.7 If Cs-137 is greater than two times the 95% lower limit of detection (LLD) for Cs-137 (per SOP-CHR-16), observe Co-60 region of interest (ROI) and Am-241 ROI.

5.8 Perform estimate of Co-60 and Am-241 using spectrum strip, background subtraction and SOP-CHR-14.

5.9 Obtain 13 soil samples from 5 cm (2 in.) and 10 cm (4 in.) depths for laboratory analysis per SOP-CHR-02, General Field Instructions, and SOP-CHR-10, Surface Soil Sampling, at locations shown on the proposed soil sample locations diagram.

5.10 If the on-site analytical results indicate elevated levels of radionuclides in the soil samples collected, then excavation will be performed in a 10 cm (4 in.) lift and placed on the HDPE sheeting.

5.11 Collect additional 5 cm (2 in.) soil samples and repeat 5.10 if necessary until the analytical results indicate levels equal to or less than background.

5.12 Homogenize the excavated soil on the HDPE and collect one sample for waste characterization purposes.

6.0 REQUIRED INSPECTION/ACCEPTANCE CRITERIA

Calibration check measurements of radiation survey instruments must be within three standard deviations of the mean. If two consecutive measurements fall outside this limit, the instrument must be taken out of service until it is recalibrated.

7.0 RECORDS

The following records, generated as a result of implementation of this procedure, shall be retained as quality records in accordance with DOE Order 1324.2A, Record Disposition and IT QA Program requirements.

7.1 Field Activity Daily Log (FADL)

7.2 Surface Measurements Field Log

7.3 Radiological Survey Log

8.0 REFERENCES

8.1 Requirements and Specifications

U.S. Department of Energy, Nevada Operations Office, July 1993, *Project Chariot: 1962 Tracer Study Site Assessment and Remedial Action Plan*, DOE/NV/93-085, Las Vegas, Nevada.

8.2 Related Procedures

8.2.1 SOP-CHR-02, General Field Instructions

8.2.2 SOP-CHR-10, Surface Soil Sampling

8.2.3 SOP-CHR-14, Operation of Multichannel Analyzer

8.2.4 SOP-CHR-15, Operation of Mobile Sodium Iodide Detector System

8.3 Others

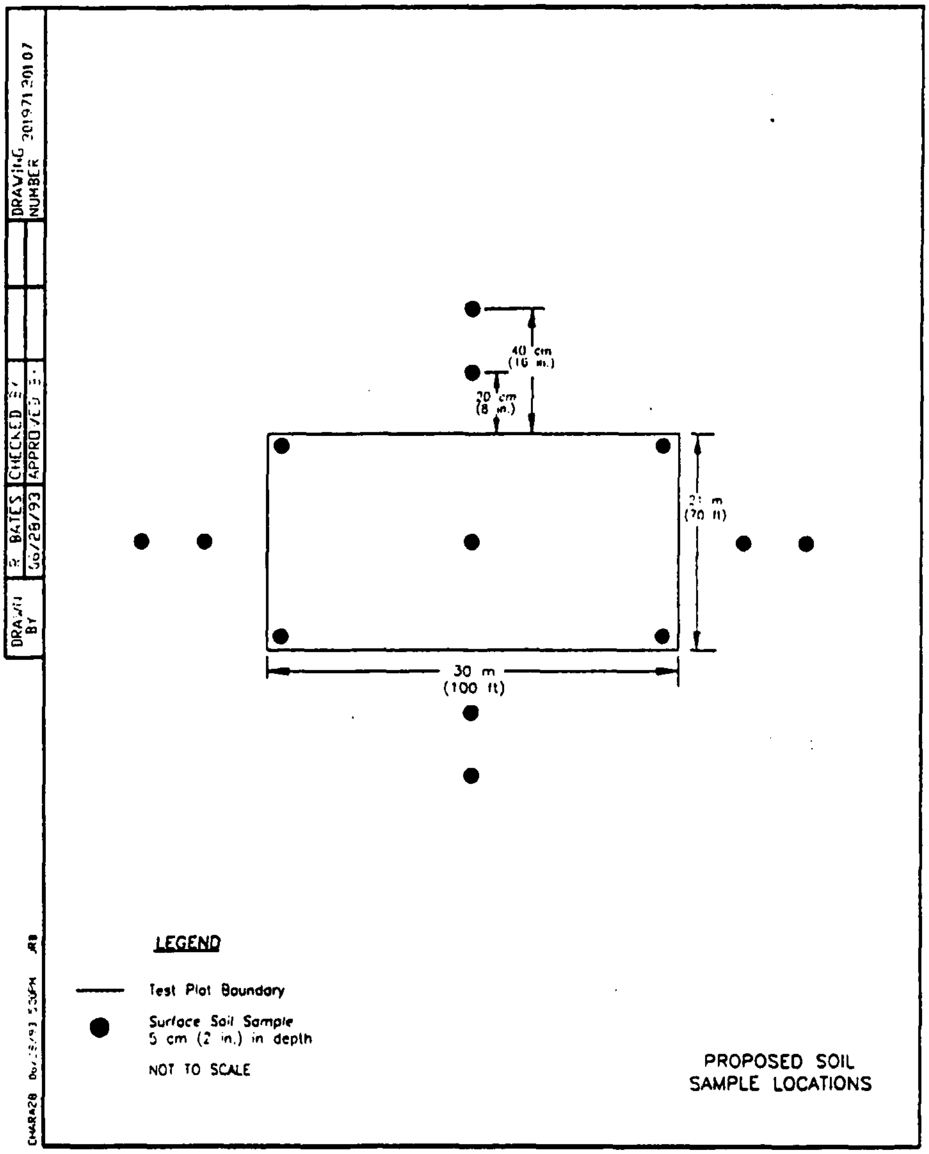
None

9.0 ATTACHMENTS

Attachment A - Proposed Soil Sample Locations

ATTACHMENT A

PROPOSED SOIL SAMPLE LOCATIONS
(Page 1 of 1)



INTERNATIONAL
TECHNOLOGY
CORPORATION

ITLV

STANDARD OPERATING PROCEDURE

NUMBER: CHR-14

TITLE: **Operation of a Multichannel Analyzer**

APPROVED: ______________________ **DATE:** 7/9/93
ITLV Program Manager

APPROVED: ______________________ **DATE:** 7-9-93
ITLV Project Manager

APPROVED: ______________________ **DATE:** 7-9-93
ITLV Quality Assurance Officer

CONTROLLED COPY NO. : _____

Revision No.	**Date**

TABLE OF CONTENTS

1.0 SCOPE AND OBJECTIVE

1.1 Scope - This procedure provides instructions for performing the measurement of gamma radioactivity in environmental media by means of gamma spectrometry. It is applicable to radionuclides emitting gamma rays with energies greater than 15 kiloelectron volts (keV).

1.2 Objective - To provide a repeatable, auditable procedure for operating the Canberra Series 10 Portable Multichannel Analyzer (MCA).

2.0 DEFINITIONS

2.1 Accuracy - The degree of agreement of an individual measurement or average of measurements with an accepted reference value or level.

2.2 Activity - An amount of radionuclide in a particular energy state at a given time. Also defined as the quotient of dN by dt, where A is the activity, and dN is the expectation value of the number of spontaneous nuclear transitions from that energy state in the time interval dt:

$$A = \frac{dN}{dt}$$

The name for the SI unit of activity is the becquerel (Bq).

2.3 Calibrated Instrument - An instrument for which the response has been documented upon being directly compared with the response of a standard instrument, both having been exposed to the same radiation field under the same conditions; or one for which the response has been documented upon being exposed to a standard radiation field under well-defined conditions.

2.4 Gamma Ray Spectrometer - A device used to measure the quantity of gamma-emitting radionuclides in a particular medium. A gamma ray spectrometer consists of a detector assembly, a power supply, an amplifier, a pulse-height analyzer, and a read-out device or devices.

2.5 May - The word may is used to denote permissibility.

2.6 Measurement System - The specific combinations of instruments, operator, and procedure used to make a particular measurement of a radiation quantity.

2.7 Multichannel Analyzer (MCA) - A device that sorts out all of the output pulses from a detector according to the pulse height. Only pulses which fall within the energy range of a channel are recorded. An energy spectrum can be obtained by looking at the output of all channels.

2.8 Photon Detection Efficiency - The ratio of the observed count rate to the known photon emission rate.

2.9 Radionuclide - A species of an atom characterized by its mass number, atomic number, and its nuclear energy state.

2.10 Resolution, gamma - The ratio (expressed as percent) of the width in energy units of the observed photopeak of a gamma emitter at half the maximum count rate to the average energy of the photopeak.

2.11 Shall - The word shall denotes a requirement.

2.12 Should - The word should is used when an element is recommended.

2.13 Standardization - Field adjustments of an instrument to known radiation sources that do not alter the basic calibration.

2.14 Uncertainty - An estimate of potential inaccuracies in a measured or derived quantity based on an explicit evaluation and combination of all sources of errors.

3.0 RESPONSIBILITIES AND QUALIFICATIONS

3.1 IT Project Manager - The IT Project Manager is responsible for assuring the implementation of this procedure by personnel trained in its proper use.

3.2 Sampling and Analysis Supervisor (SAS) - The SAS is responsible for implementing this procedure. The SAS shall ensure that all personnel selected to perform this activity are qualified.

3.3 Field Personnel - Field personnel are responsible for meeting the requirements of this procedure and the Site-Specific Health and Safety Plan (SSHASP).

3.4 Quality Assurance Officer - The Quality Assurance Officer is responsible for approving this procedure and performing surveillances to verify compliance with this procedure.

4.0 MATERIALS/EQUIPMENT AND CALIBRATION REQUIRED

4.1 Material/Equipment

- Field Activity Daily Log
- Sodium Iodide (NaI) Detector (3 inch by 3 inch)
- Lead shield for NaI detector
- Preamplifier
- Amplifier
- High voltage power supply
- Analog to digital converter
- Multichannel analyzer
- Electronic data storage device(s)
- Data analyzer (internal or computer)
- Printout device
- Radiation check sources
- HASL-258

4.2 Calibration Required

4.2.1 The instrument being used shall be calibrated prior to use at least annually and have a current calibration certificate.

4.2.2 Any instrument exceeding the stated calibration expiration date shall not be used and shall be tagged "out of service."

4.2.3 Operational and source checks shall be performed and recorded before and after an instrument is used.

5.0 METHOD

5.1 Calibration

5.1.1 The MCA shall be operated according to the manufacturer's instructions.

5.1.2 An appropriate radionuclide standard shall be placed 1 meter below the detector. The type, form, and geometry of the standard and the samples to be counted shall be identical.

5.1.3 The energy response of the MCA system shall be determined with standards containing known radionuclides.

5.1.3.1 The standards may be sealed and should emit gammas at an energy between 15 keV to 3 mega electron volts (MeV).

5.1.3.2 The energy response shall include at least two different energies and should cover the range from 200 keV to 3 MeV.

5.1.3.3 As necessary, the amplifier gain shall be adjusted until the Cs-137 photopeak is about one-third of the full scale.

5.1.3.4 After the gain adjustment, a pulse height spectrum shall be acquired for a sufficient time period to ensure statistical confidence.

5.1.3.5 The ENERGY CALIBRATION feature of the Portable Multichannel Analyzer shall be used to perform a two-point energy calibration.

5.1.4 The photon detection efficiency, as a function of gamma energy, shall be determined.

5.1.4.1 The photon detection efficiency shall be calculated for the photopeak of interest in samples to be analyzed.

5.1.4.2 Spectral data from known standards of each gamma-emitting radionuclide expected to be in the samples shall be acquired.

5.1.4.3 The complete spectrum of a standard of the radionuclide of interest shall be graphically or spectrally stripped using the FRACTIONAL SPECTRUM STRIPPING and the NET AREA features of the Portable Multichannel Analyzer in order to determine the count rate for each energy region of interest.

5.1.4.4 The photon detection efficiency (counts per minute [cpm] per microcurie) versus gamma ray energy shall be plotted on rectangular coordinate paper (e.g., FADL).

5.2 <u>Acquisition of Sample Data</u>

5.2.1 A background count shall be performed at the beginning and at the conclusion of each day, with the average of the two values used to compute the results for sample data. The count shall be performed in a designated area of the basecamp opposite from the mound.

5.2.2 The validity of the efficiency curve shall be confirmed at the beginning and end of each day.

5.2.3 Repeat step 5.1.4.4.

5.2.4 An energy calibration shall be performed at the beginning and at the conclusion of each day.

5.2.5 The NaI detector of the system shall be placed 1 meter above the area to be surveyed, suspended from a tripod.

5.2.6 A pulse height spectrum shall be acquired over a sufficient time period (10 minutes) to assure adequate statistical confidence.

5.2.7 From the positions of the photopeaks and from the history of the samples, Cs-137, Co-60, and Am-241 present in the sample shall be identified. If the evidence is insufficient to permit identification of radionuclides of concern, samples shall be collected and submitted to the on-site lab for analysis.

5.2.8 The sample counts in the energy region of interest shall be obtained using the NET AREA feature of the Portable Multichannel Analyzer.

5.3 <u>Interpretation of Results</u>

5.3.1 The concentration of each of the components in the sample shall be determined algebraically.

5.3.2 The following calculation shall be performed:

$$\text{dpm} = \frac{C}{A \times \varepsilon}$$

Where:

dpm = the disintegrations per minute in photopeak of interest;
C = the observed counts per minute;
A = the fractional abundance of the gamma ray, in gammas per disintegration; and
ε = the photon detection efficiency as shown on the photon detection efficiency curve.

Note: This is only correct for the source type and position. It is not correct for field in-situ measurements with the MCA (see 5.4.2).

5.4 Minimum Detectable Activity

5.4.1 The minimum detectable activity shall be determined by the following for each radionuclide of interest:

$$MDA \approx 4.65K\sigma_B \text{ (95\% Confidence)}$$

Where:

MDA = the minimum detectable activity;
K = the efficiency calibration (e.g., microcuries in sample per cpm); and
σ_B = the standard deviation of the background (bg) count.
σ_B = $\sqrt{\text{bg count}}$

Note: This is only correct for the source type and position. It is not correct for field in-situ measurements with the MCA.

5.4.2 MDA calculations for in-situ measurements are dependent on the distribution of the radionuclides in the soil. The in-situ MDAs shall be calculated by the methods in HASL-258.

5.4.3 The Lower Limit of Detection shall be determined pursuant to procedure SOP-CHR-16.

6.0 REQUIRED INSPECTION/ACCEPTANCE CRITERIA

Background and calibration counts must be within two standard deviations of the mean for each type count, or additional counts shall be performed. Two of three counts must meet this criteria prior to use of instrument.

7.0 RECORDS

The following records generated as a result of implementation of this procedure shall be retained as quality records in accordance with DOE Order 1324.2A, Record Disposition and IT QA Program requirements.

7.1 Results of gamma spectral analyses, including hard-copy printouts of channel-by-channel data and logbooks.

7.2 Instrument quality control charts.

7.3 Multichannel Analyzer Instrument Check Form.

7.4 Multichannel Analyzer Survey Form.

7.5 Field Activity Daily Log.

8.0 REFERENCES

8.1 Requirements and Specifications

U.S. Department of Energy, Nevada Operations Office, July 1993, *Project Chariot: 1962 Tracer Study Site Assessment and Remedial Action Plan*, DOE/NV/93-085, Las Vegas, Nevada.

8.2 Related Procedures

8.2.1 Instruction Manual for Canberra Portable Plus Multichannel Analyzer.

8.2.2 SOP-CHR-18, Daily Source and Background Checks.

8.2.3 SOP-CHR-16, Determination of Lower Limits of Detection

8.2.4 Beck, H.L., et. al., 1972, "In-Situ Ge (Li) and NaI (Tl) Gamma-Ray Spectrometry," Health and Safety Laboratory, U.S. Atomic Energy Commission, New York, New York, HASL-258.

8.3 Others

8.3.1 Knoll, G.F., Radiation Detection and Measurement, J. Wiley and Sons, 1979.

8.3.2 "Measurement of Low Level Radioactivity," International Commission on Radiation Quantities and Units, ICRU Report No. 22, 1972.

8.3.3 "Radiation Protection Instrumentation and its Application," International Commission on Radiation Quantities and Units, ICRU Report No. 20, 1971.

8.3.4 "Radiation Protection Instrumentation Test and Calibration," American National Standards Institute, ANSI-N323, 1978.

8.3.5 "Instrumentation and Monitoring Methods for Radiation Protection," National Council on Radiation Protection and Measurements, NCRP Report No. 57, 1978.

9.0 ATTACHMENTS

9.1 Attachment A - Multichannel Analyzer Instrument Check Form

9.2 Attachment B - Instrument Quality Control Chart

9.3 Attachment C - Multichannel Analyzer Survey Form

ATTACHMENT A

MULTICHANNEL ANALYZER INSTRUMENT CHECK FORM
(Page 1 of 1)

Instrument Manufacturer ______________ Date ______________
MCA Model ______________ Serial No. ______________
Detector Model ______________ Serial No. ______________
Source ID ________ Isotope ________ Activity ________ as of ________
Source ID ________ Isotope ________ Activity ________ as of ________

	Time	Count Time (minute)	Cs-137 ROI (counts)	Co-60 ROI (counts)	k-40 ROI (counts)	U-238 ROI (counts)	Bi-214 ROI (counts)	Total (counts)	Initials
Indoor Background (counts)									
Outdoor Background (counts)									
Channel No.									
Cs-137 Source (counts)									
Mixed Gamma Source (counts)									
Spectrum No.									Spectrum Location
1									
2									
3									
4									
5									
6									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									

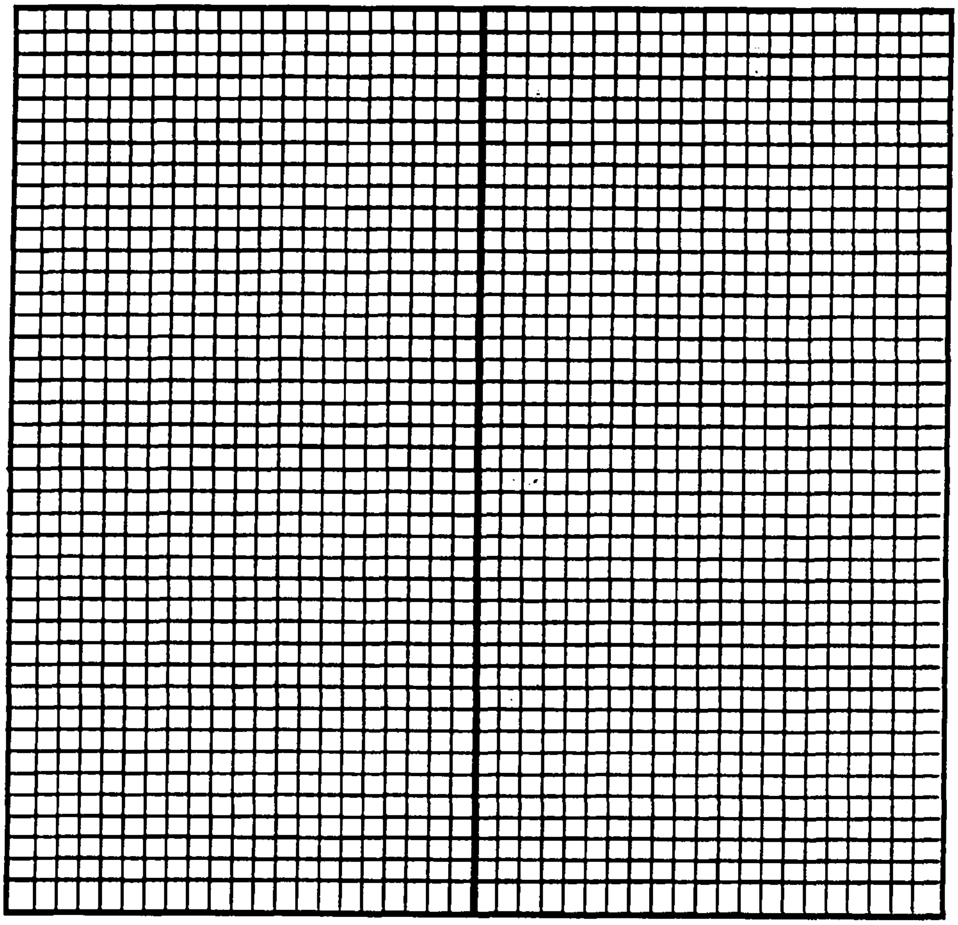
Battery Response	Lower Level Limit (channel)	Upper Level Limit (channel)	Gain Setting	keV per Channel	Net Count[a]	Efficiency[b] $\left(\frac{cpm}{dpm}\right)$

(a) Net Count = Source Count - Indoor Background Count. Record this value on the Instrument Quality Control
(b) Efficiency = Cs-137 ROI (Counts) - Cs-137 Source (dpm)

ATTACHMENT B

INSTRUMENT QUALITY CONTROL CHART
(Page 1 of 1)

Model Number ______________ Serial Number ______________



$\bar{x}$

Net Count Rate (cpm)

Directions:

Record the date and the net count rate from the source of the instrument. Count rates should not be greater than ± three standard deviations from the mean (x)

ATTACHMENT C

MULTICHANNEL ANALYZER SURVEY FORM
(Page 1 of 1)

Instrument Manufacturer ______________________ Date ______________
MCA Model ______________________ Serial No. ______________
Detector Model ______________________ Serial No. ______________

Number	Time	Count Time (Min)	Cs-137 ROI (Counts)	Co-60 ROI (Counts)	K-40 ROI (Counts)	U-238 ROI (Counts)	Bi-214 ROI (Counts)	Total Counts	Initials	Location
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										

Comments: ____

INTERNATIONAL
TECHNOLOGY
CORPORATION

ITLV

STANDARD OPERATING PROCEDURE

NUMBER: CHR-15

TITLE: **Operation of Mobile Sodium-Iodide Detection System**

APPROVED: ____________________ **DATE:** 7/9/93
ITLV Program Manager

APPROVED: ____________________ **DATE:** 7 - 9 - 93
ITLV Project Manager

APPROVED: ____________________ **DATE:** 7-9-93
ITLV Quality Assurance Officer

CONTROLLED COPY NO. : _____

Revision No.	Date

TABLE OF CONTENTS

1.0 SCOPE AND OBJECTIVE

1.1 Scope - This procedure applies to operation of the mobile sodium-iodide (NaI) detection system at the 1962 Tracer Study Test Plot Area of the Project Chariot Site.

1.2 Objective - The objective of this procedure is to provide a method for operating the NaI-based detector system for determination of elevated levels of radioactivity in soils at the test plots.

2.0 DEFINITIONS

2.1 Calibration - The check or correction of the accuracy of a measuring instrument to assume proper operational characteristics.

2.2 Lower Limit of Detection (LLD) - The smallest amount of sample activity that will yield a net count for which there is confidence at a predetermined level that the activity measured is actually present.

2.3 May - The word may is used to denote permissibility.

2.4 Shall - The word shall denotes a requirement.

2.5 Should - The word should is used when an element is recommended.

2.6 Sodium-Iodide (NaI) Detector System - The NaI detection system is a combination of a NaI scintillation detector with an Eberline ESP-2 rate meter.

3.0 RESPONSIBILITIES AND QUALIFICATIONS

3.1 IT Project Manager - The IT Project Manager is responsible for assuring the implementation of this procedure during the performance of project activities.

3.2 Quality Assurance Officer - The Quality Assurance Officer is responsible for approving this procedure and performing surveillances to verify compliance with this procedure.

3.3 Sampling and Analysis Supervisor (SAS) - The SAS shall select qualified personnel to perform this activity.

3.4 Field Personnel - Field personnel are responsible for meeting the requirements of this procedure and of the Site-Specific Health and Safety Plan (SSHASP).

4.0 MATERIALS/EQUIPMENT AND CALIBRATION REQUIRED

4.1 Material/Equipment

- NaI/ESP-2 detection system with associated equipment and attachments
- Cesium-137 (Cs-137) check source
- Field Activity Daily Log (FADL)
- ESP-2 Operation Manual

4.2 Calibration Required

4.2.1 The instrument being used shall be calibrated prior to use at least annually and have a current calibration certificate.

4.2.2 Any instrument exceeding the stated calibration expiration date shall not be used and shall be tagged "out of service."

4.2.3 Operational and source checks shall be performed and recorded before and after an instrument is used.

5.0 METHOD

5.1 Initial Settings

5.1.1 Press ON/OFF control button to turn the instrument "on". Use the same button to turn the instrument "off".

5.1.2 Press MODE/STORE button to enter the setup menu.

5.1.3 Use the flow diagrams in Attachments A, B, and C and the corresponding keystrokes on the instrument to set the parameters.

5.1.4 For background and source checks, set the instrument to operate in "SCALER MODE AVERAGE RATE."

5.1.5 For taking field measurements, set the instrument to operate in "RATE METER MODE."

5.1.6 Set the units "BASE" to "CNT", the units "SUFFIX" to "MIN" and the units "PREFIX" to "NONE."

5.1.7 For operation in the scale mode, set the counting time "CNT for X:XX:XX" as specified in SOP-CHR-18, Daily Source and Background Checks.

5.1.8 Set the operational alarm "ALM at X:XX:XX" to the 95 percent lower limit of detection as specified in SOP-CHR-16, Determination of Lower Limits of Detection.

5.1.9 Press the MODE/STORE button to exit the setup menu.

5.2 Battery Check

5.2.1 Turn the instrument on.

5.2.2 If a flashing cursor appears in the upper left hand corner, there is less than 1 hour of operating time and the battery should be changed.

5.3 Background and Source Checks

5.3.1 Background and source checks shall be performed in the Average Rate Scaler Mode.

5.3.2 For operation in this mode, follow the flow chart in Attachment D. The operation should include only the counting mode and not the data logging device.

5.3.3 SOP-CHR-18, Daily Source and Background Checks, shall be followed for performance of the required checks.

5.4 Field Measurements

5.4.1 Three precautionary measures shall be taken when using the NaI detectors.

(1) The detectors are designed to operate in normal laboratory temperatures between 40 and 120 degrees Fahrenheit. The detector shall not experience temperature changes of more than 15 degrees Fahrenheit per hour.

(2) These detectors should be handled with care. Mechanical shock can cause fracturing of the scintillation crystal.

(3) The detectors should not be exposed to moisture that could cause the diode (pins) structure to short out.

5.4.2 Field measurements shall be taken using the normal Rate Meter Mode.

5.4.3 For operation in this mode, follow the flow chart in Attachment E. The operation should include only the counting mode and not the data logging device.

5.4.4 SOP-CHR-03, Walk-Over Surveys using a Large Volume Scintillation Detector, shall be followed for performance of the detector system in the field.

5.5 Calculations

5.5.1 Net Count, in counts per minute (cpm) = Cesium Source (cpm) - Indoor Background (cpm).

5.5.2 Average net count rate ($\bar{x}$):

$$\bar{x} = \frac{1}{n_s} \sum_{i=1}^{n_s} x_i$$

Where:

n_s = number of individual net count rates used to determine $\bar{x}$
$\bar{x}$ = calculated mean (average); and
x_i = individual net count rate.

5.5.3 Standard deviation (s):

$$s = \sqrt{\frac{\sum_{i=1}^{n_s} (\bar{x}-x_i)^2}{n-1}}$$

Where:

s = standard deviation

6.0 REQUIRED INSPECTION/ACCEPTANCE CRITERIA

Calibration check measurements of radiation survey instruments must be within three standard deviations of the mean. If two consecutive measurements fall outside this limit the instrument must be taken out of service until it is recalibrated.

7.0 RECORDS

The following records generated as a result of implementation of this procedure shall be retained as quality records in accordance with DOE Order 1324.2A, Record Disposition and IT QA Program requirements.

- Field Activity Daily Log

8.0 REFERENCES

8.1 Requirements and Specifications

8.1.1 U.S. Department of Energy, Nevada Operations Office, July 1993, *Project Chariot: 1962 Tracer Study Site Assessment and Remedial Action Plan*, DOE/NV/93-085, Las Vegas, Nevada.

8.1.2 ESP-2, Eberline Smart Portable Technical Manual, July 1992

8.2 Related Procedures

8.2.1 SOP-CHR-03, Walk-over Surveys Using a Large Volume Scintillation Counter

8.2.2 SOP-CHR-16, Determination of Lower Limits of Detection

8.2.3 SOP-CHR-18, Daily Source and Background Checks

8.3 Others - None

9.0 ATTACHMENTS

9.1 Attachment A - Parameters Mode

9.2 Attachment B - Selecting Units

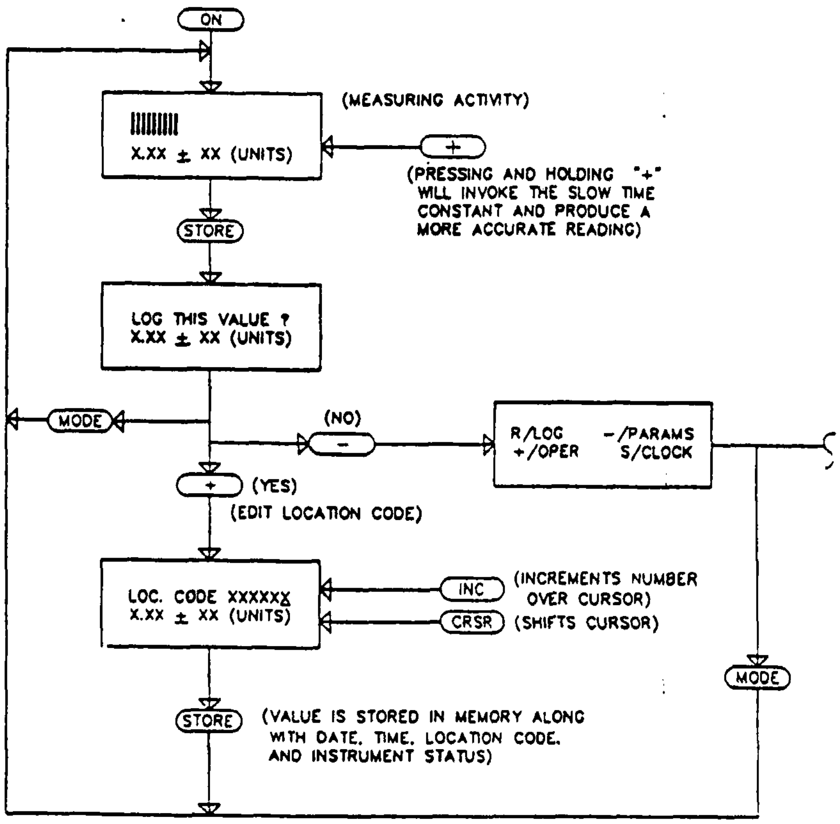
9.3 Attachment C - Selecting Operating Modes

9.4 Attachment D - Average Rate Scaler Mode

9.5 Attachment E - Normal Rate Meter Mode

ATTACHMENT A

NORMAL RATE METER MODE
(Page 1 of 1)



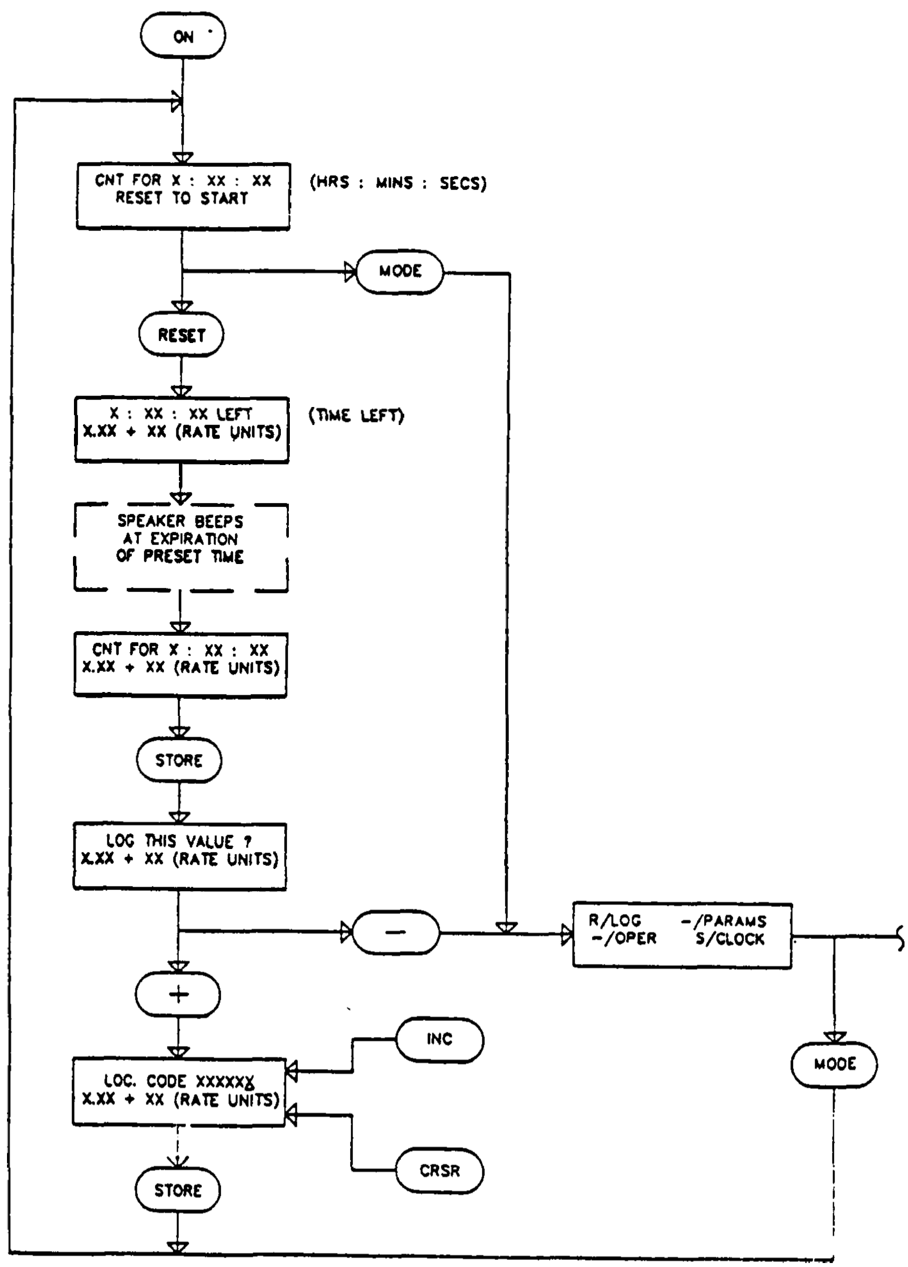
ESP-2 FUNCTIONAL FLOW DIAGRAM

NOTES FOR BLOCK DIAGRAMS

1. (rounded box) = KEY INPUT
2. (box) = DISPLAY
3. (UNITS) = CURRENT SELECTED UNITS, e.g. cnt/s
4. (NOTE) = EXPLANATION NOTE
5. (dashed box) = INTERNAL FUNCTION NOT DISPLAYED

ATTACHMENT B

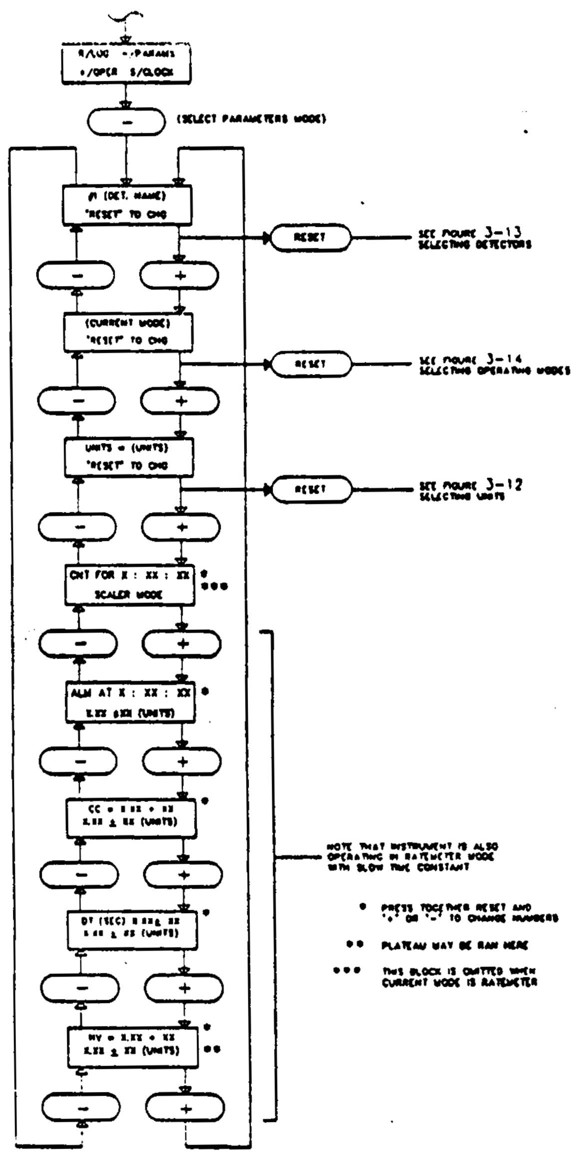
AVERAGE RATE SCALER MODE
(Page 1 of 1)



Average Rate Scaler Mode, 11383-C18

ATTACHMENT C

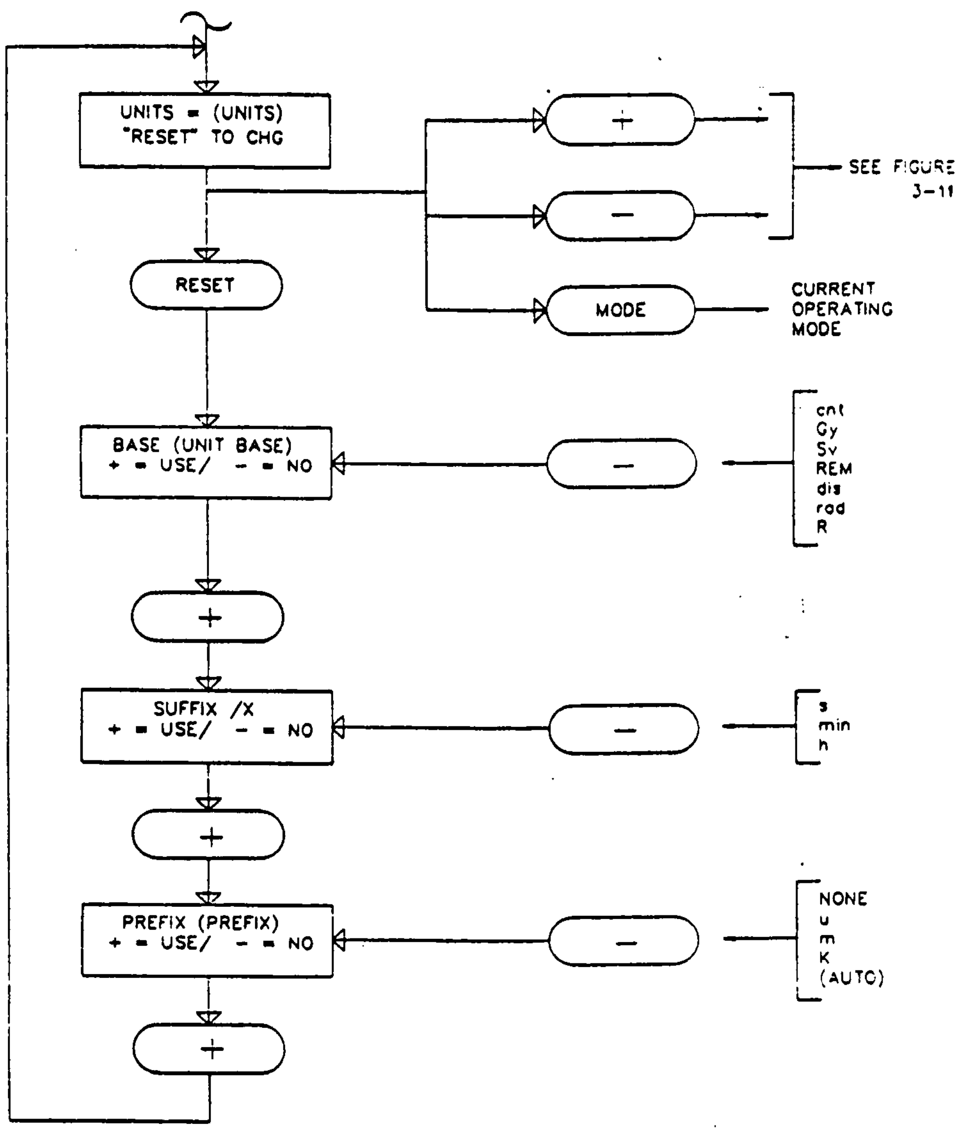
PARAMETERS MODE
(Page 1 of 1)



Parameters Mode, 11383-C22

ATTACHMENT D

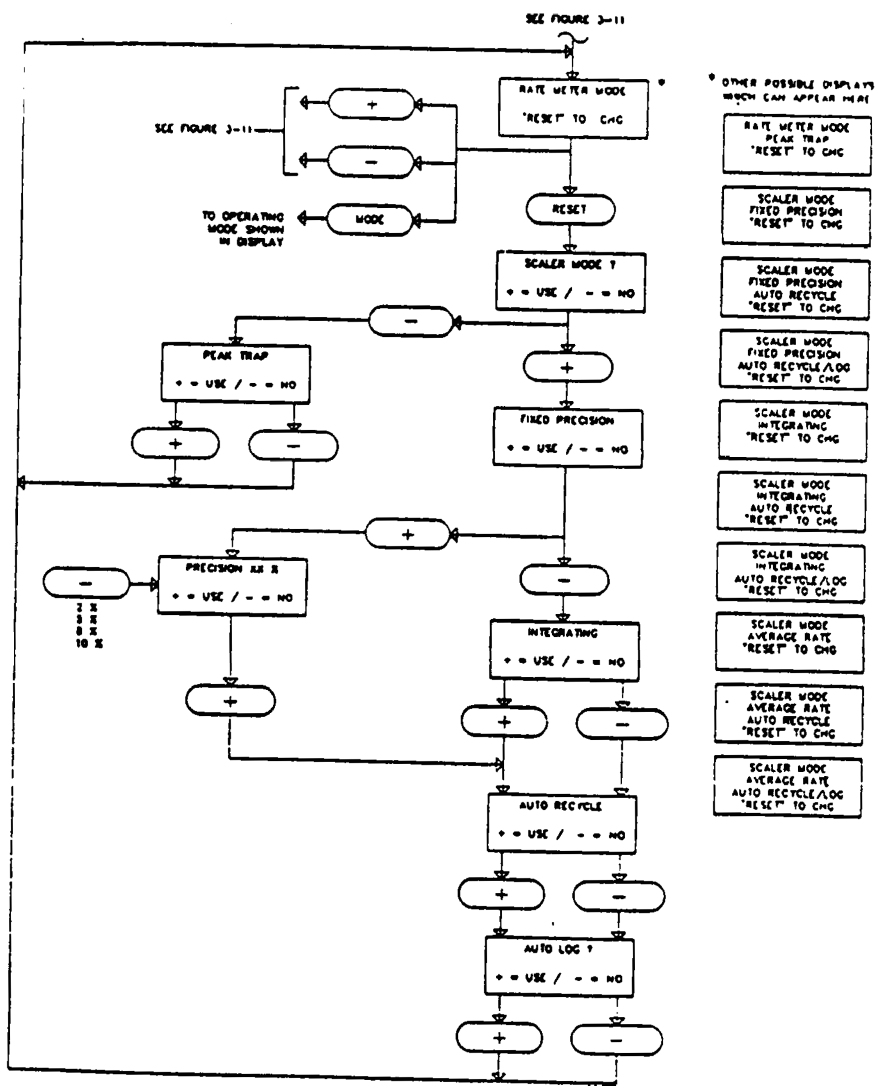
SELECTING UNITS
(Page 1 of 1)



Selecting Units, 11383-C23

ATTACHMENT E

SELECTING OPERATING MODES
(Page 1 of 1)



Selecting Operating Modes, 11383-C25

This page intentionally left blank

INTERNATIONAL
TECHNOLOGY
CORPORATION

ITLV

STANDARD OPERATING PROCEDURE

NUMBER: CHR-16

TITLE: **Determination of Lower Limits of Detection**

APPROVED: ________________ **DATE:** 7/9/93
ITLV Program Manager

APPROVED: ________________ **DATE:** 7-9-93
ITLV Project Manager

APPROVED: ________________ **DATE:** 7-9-93
ITLV Quality Assurance Officer

CONTROLLED COPY NO. : _____

Revision No.	**Date**

TABLE OF CONTENTS

1.0 SCOPE AND OBJECTIVE

1.1 Scope - This procedure is applicable to site characterization gamma radiation surveys performed at the Project Chariot Site.

1.2 Objective - To provide a method for determining the Lower Limit of Detection (LLD) of Cesium-137 (Cs-137) using a NaI detector.

2.0 DEFINITIONS

2.1 Characterization Survey - Site sampling, monitoring, and analysis activities to determine the extent and nature of radioactive contamination.

2.2 Lower Limit of Detection (LLD) - The smallest amount of sample activity that will yield a net count for which there is confidence at a predetermined level that the activity measured is actually present.

2.3 May - The word may is used to denote permissibility.

2.4 Multichannel Analyzer (MCA) - A device that sorts out all of the output pulses from a detector according to the pulse height. Only pulses which fall within the energy range of a channel are recorded. An energy spectrum can be obtained by looking at the output of all channels.

2.5 Pressurized Ion Chamber (PIC) - An ultra-sensitive gamma exposure monitoring device that can be used to determine the lower level gamma ray exposure rates, such as those due to fallout and natural background external gamma exposure rates at a height of 1 meter above the soil surface. It measures and records gamma exposure rates, and provides a readout in microRoentgen/hour (μR/hr).

2.6 Shall - The word shall denotes a requirement.

2.7 Should - The word should is used when an element is recommended.

2.8 Sodium Iodide (NaI) Detector - A scintillation crystal which is effective in the detection of gamma radiation.

2.9 Survey - Evaluation of a representative portion of a population to develop conclusions regarding the population as a whole.

3.0 RESPONSIBILITIES AND QUALIFICATIONS

3.1 IT Project Manager - The IT Project Manager is responsible for assuring the implementation of this procedure during the performance of project activities.

3.2 Quality Assurance Officer - The Quality Assurance Officer is responsible for approving this procedure and performing surveillances to verify compliance with this procedure.

3.3 Sampling and Analysis Supervisor (SAS) - It is the responsibility of SAS to ensure that field personnel follow this procedure during the field program and to delegate the performance of this procedure to personnel experienced with its provisions and with the PIC and the NaI system.

3.4 Field Personnel - It is the responsibility of all field personnel to meet the requirements of this procedure, the Site-Specific Health and Safety Plan (SSHASP), and to report any abnormal occurrences or results to the Sampling and Analysis Supervisor immediately.

4.0 MATERIALS/EQUIPMENT AND CALIBRATION REQUIRED

4.1 Material/Equipment

- 3- by 3-inch NaI detector
- Eberline Model ESP-2 ratemeter
- Reuter-Stokes PIC
- Canberra Portable Multichannel Analyzer (MCA), or equivalent
- Stop watch
- Graph paper, normal and log-normal
- Field Activity Daily Log

4.2 Calibration Required

4.2.1 The instruments being used shall be calibrated prior to use at least annually and have a current calibration certificate.

4.2.2 Any instrument exceeding the stated calibration expiration date shall not be used and shall be tagged "out of service".

4.2.3 Operational and source checks shall be performed and recorded before and after an instrument is used. Refer to SOP-CHR-14, Operation of a Multichannel Analyzer, and SOP-CHR-15, Operation of a Mobile Sodium-Iodide Detector System.

5.0 METHOD

5.1 NaI and ESP-2

5.1.1 Full spectrum of Canberra Portable MCA and NaI ESP-2

5.1.1.1 Determine µR/hr relationship to PIC (µR/hr/cpm) as per SOP-CHR-17.

5.1.1.2 Obtain background measurements at a minimum of 20 locations for 1 and 10 minute counts.

5.1.1.3 Collect measurements near the mound and three remote background sites to be determined in the field.

5.1.1.4 Plot background vs. percentile on normal and log-normal graph paper to determine if local and remote values belong to the same distribution. Use local background if the distributions are different.

5.1.1.5 Calculate the 95% LLD of a difference from the background counts using the following formula. Obtain the mean and standard deviation of the background from the probability plots. Mean ($\bar{x}_B$) is the 50th percentile value from probability plots. Standard deviation (σ_{bg}) is the 84th minus the 50th percentile values.

$$95\%\ \mathrm{LLD} = 2.71 + 4.66\sqrt{bg}$$

$$\sqrt{bg} = \left[(\bar{x}_B) + \sigma_{bg}^2\right]^{1/2}$$

Where:

LLD = Lower Limit of Detection;
$\bar{x}_B$ = mean background counts;
bg = background measurement (each in 1 or 10 minute counts); and
σ_{bg} = standard deviation of the background counts.

5.1.2 Cs-137 Region Of Interest

Repeat same steps as 5.1.1, full spectrum, and compare to PIC readings.

5.2 <u>NaI and MCA</u>

5.2.1 Set Cs-137 region of interest per SOP-CHR-14 (i.e, manufacturer's instructions).

5.2.2 Perform spectrum strip and background subtraction per SOP-CHR-14 (subtract uranium, thorium, and potassium backgrounds separately based on one or more indicator peaks).

5.2.3 Obtain net counts in the Cs-137 region of interest for a minimum of 20 background locations.

5.2.4 Plot on normal and log-normal graph paper to determine if background is one or more different distributions.

5.2.5 Use only local background set if there are different distributions.

5.2.6 Determine the mean and standard deviation of the Cs-137 background from the probability plots. Then calculate the 95% LLD by:

$$95\%\ \text{LLD} = 2.71 + 4.66\sqrt{bg}$$

$$\sqrt{bg} = \left[(\bar{x}_B) + \sigma_{bg}^2\right]^{1/2}$$

Where:

LLD = Lower Limit of Detection;
bg = background measurement;
$\bar{x}_B$ = mean background count (10 minute count); and
σ_B = standard deviation of the background counts.

6.0 REQUIRED INSPECTION/ACCEPTANCE CRITERIA

Obtain a confirmation that the LLD determined meets the project requirements as specified in the Sampling and Analysis Plan.

7.0 RECORDS

The following records generated as a result of implementation of this procedure shall be retained as quality records in accordance with DOE Order 1324.2A, Record Disposition and IT QA Program requirements.

- Calculation sheets with graphed plots

8.0 REFERENCES

8.1 Requirements and Specifications

U.S. Department of Energy, Nevada Operations Office, July 1993, *Project Chariot: 1962 Tracer Study Site Assessment and Remedial Action Plan*, DOE/NV/93-085, Las Vegas, Nevada.

8.2 Related Procedures

8.2.1 SOP-CHR-14, Operation of Multichannel Analyzer

8.2.2 SOP-CHR-15, Operation of Mobile Sodium-Iodide Detection System

8.2.3 SOP-CHR-17, Correlation of Sodium Iodide Readings with Pressurized Ion Chamber

8.3 Others

Currie, L. A., *Limits for Qualitative Detection and Quantitative Determination*, Analytical Chemistry, Vol. 4 No. 3, March 1968.

9.0 ATTACHMENTS

None

INTERNATIONAL
TECHNOLOGY
CORPORATION

ITLV

STANDARD OPERATING PROCEDURE

NUMBER: CHR-17

TITLE: Correlation of Sodium Iodide Detector with the Pressurized Ion Chamber

APPROVED: Joseph Ulfenstad — ITLV Program Manager **DATE:** 7/9/93

APPROVED: Andrea M. Hoff — ITLV Project Manager **DATE:** 7-9-93

APPROVED: Cheryl D. Prince — ITLV Quality Assurance Officer **DATE:** 7-9-93

CONTROLLED COPY NO. : _____

REVISION NO.	DATE

TABLE OF CONTENTS

1.0 SCOPE AND OBJECTIVE

1.1 Scope - This procedure applies to all correlations of Sodium Iodide (NaI) Scintillation Detector measurements with more accurate pressurized ion chamber (PIC) measurements.

1.2 Objective - The objective of this procedure is to provide the methodology for correlating count rate measurements obtained by using an NaI Detector coupled to a ratemeter/scaler to the exposure rate measurements taken with the PIC.

2.0 DEFINITIONS

2.1 May - The word may is used to denote permissibility.

2.2 Pressurized Ionization Chamber (PIC) - An ultra-sensitive gamma exposure monitoring device that can be used to determine the lower level gamma ray exposure rates, such as those due to fallout and natural background external gamma exposure rates at a height of 1 meter above the soil surface. It measures and records gamma exposure rates, and provides a readout in microRoentgen/hour (μR/hr).

2.3 Shall - The word shall denote a requirement.

2.4 Should - The word should is used when an element is recommended.

2.5 Sodium Iodide (NaI) Detector - A scintillation crystal device which is very effective in the detection of gamma radiation.

3.0 RESPONSIBILITIES AND QUALIFICATIONS

3.1 IT Project Manager - The IT Project Manager is responsible for assuring the implementation of this procedure during the performance of project activities.

3.2 Sampling and Analysis Supervisor (SAS) - It is the responsibility of the SAS, or designee, to delegate the performance of this procedure to personnel that are knowledgeable in the requirements of this procedure and experience in the use of the PIC and the NaI Detector.

3.3 Quality Assurance Officer - The Quality Assurance Officer is responsible for approving this procedure and performing surveillances to verify compliance with this procedure.

3.4 Field Personnel - Field personnel are responsible for meeting the requirements of this procedure and the Site-Specific Health and Safety Plan (SSHASP).

4.0 MATERIALS/EQUIPMENT AND CALIBRATION REQUIRED

4.1 Equipment and Material

- 3- by 3-inch NaI Detector
- Eberline Model ESP-2 Ratemeter
- Reuter-Stokes PIC Model RSS-112
- Site map
- Exposure Rate Correlation Data Entry Form
- Field Activity Daily Log (FADL)

4.2 Calibration Required

4.2.1 The ESP-2 with NaI detector shall be calibrated using an National Institute of Science and Technology (NIST) traceable source at least annually and have a current calibration certificate.

4.2.2 The PIC shall be calibrated using an NIST traceable source at least annually and have a current calibration certificate.

4.2.3 Any instrument exceeding the stated calibration expiration date shall not be used and shall be tagged "out of service."

4.2.4 Operational and source checks shall be performed and recorded at the beginning and the end of each shift in which an instrument is used.

5.0 METHOD

5.1 Site-Specific Measurements with NaI Detector and PIC

5.1.1 See that the NaI Detector and the PIC are operating properly.

5.1.2 Take measurements alternately at each location with both instruments at approximately 1 meter from ground surface.

5.1.3 Allow the PIC to stabilize for 1 minute before recording the data.

5.1.4 Allow the NaI detector to stabilize for at least 1 minute before recording the data.

5.1.5 Record results on the Site-Specific Exposure Rate Correlation Data Entry Form (Attachment A).

5.1.6 This procedure shall be repeated for at least seven locations. These same seven locations shall be surveyed each time. These locations will be selected in the field.

5.2 Correlation by Use of a Linear Regression

After performing measurements per Section 5.1 above, correlate the readings from the PIC and the NaI detector using the following equation:

$$E = a(Em) + b$$

Where:

E = the PIC reading in μR/hr,
a = the slope of the line,
Em = the NaI detector reading in counts per time interval, and
b = the Y-axis intercept.

6.0 REQUIRED INSPECTION/ACCEPTANCE CRITERIA

6.1 All calculations must be checked by a person other than the originator prior to finalization and filing.

6.2 Calibration check measurements of radiation survey instruments must be within three standard deviations of the mean. If two consecutive measurements fall outside this limit, the instrument must be removed from service until it is recalibrated.

7.0 RECORDS

The following records, generated as a result of implementation of this procedure, shall be retained as quality records in accordance with DOE Order 1324.2A, Record Disposition and IT QA Program requirements.

7.1 Correlation calculation briefs

7.2 Exposure Rate Correlation Data Entry Form

8.0 REFERENCES

8.1 Requirements and Specifications

8.1.1 Reuter-Stokes RSS-112 PIC Portable Environmental Radiation Monitor Operational Manual, January 1993.

8.1.2 ESP-2, Eberline Smart Portable Technical Manual, July 1992.

8.2 Related Procedures

8.2.1 SOP-CHR-11, Exposure Rate Measurements Using a PIC

8.2.2 SOP-CHR-15, Operation of Mobile Sodium Iodide Detector System

8.3 Other - None

9.0 ATTACHMENTS

Attachment A - Exposure Rate Correlation Data Entry Form

ATTACHMENT A

EXPOSURE RATE CORRELATION DATA ENTRY FORM
(Page 1 of 1)

Site: ______________________________ Location: ____________________

Date: ______________ Survey No.: ________________ Surveyor: ____________

Location			PIC #_________ μR/hr at 1 meter	Inst. #___________ cpm at 1 meter	Correlation Factor $\left(\frac{\mu R/hr}{cpm}\right)$
N-S	E-W	Section			

Note: cpm = counts per minute

INTERNATIONAL
TECHNOLOGY
CORPORATION

ITLV

STANDARD OPERATING PROCEDURE

NUMBER: CHR-18

TITLE: **Daily Source and Background Checks**

APPROVED: ______________________ **DATE:** 7/9/93
ITLV Program Manager

APPROVED: ______________________ **DATE:** 7 - 9 - 93
ITLV Project Manager

APPROVED: ______________________ **DATE:** 7-9-93
ITLV Quality Assurance Officer

CONTROLLED COPY NO. : _____

Revision No.	**Date**

TABLE OF CONTENTS

1.0 SCOPE AND OBJECTIVE

1.1 Scope - This procedure applies to all daily source and background checks for all radiation detection instruments at the 1962 Tracer Study Test Plot Area of the Project Chariot Site.

1.2 Objective - The objective of this procedure is to provide a method of consistency for conducting daily source and background checks.

2.0 DEFINITIONS

2.1 Calibration - The check or correction of the accuracy of a measuring instrument to assume proper operation characteristics.

2.2 Counter - A general designation applied to radiation detection instruments of survey meters that detect and measure radiation. The signal that announces an ionization event is called a count.

2.3 Detector - A material or device that is sensitive to radiation and can produce a response signal suitable for measurement or analysis.

2.4 Geiger-Mueller Counter - A radiation detection and measuring instrument. It consists of a gas-filled tube containing electrodes, between which there is an electrical voltage but no current flowing. When ionizing radiation passes through the tube, a short, intense pulse of current passes from the negative electrode to the positive electrode and is measured or counted. The number of pulses per second measures the intensity of radiation.

2.5 May - The word may is used to denote permissibility.

2.6 Multichannel Analyzer (MCA) - A device that sorts out all of the output pulses from a detector according to the pulse height. Only pulses which fall within the energy range of a channel are recorded. An energy spectrum can be obtained by looking at the output of all channels.

2.7 Pressurized Chamber (PIC) - An ultra-sensitive gamma exposure monitoring device that can be used to determine the lower level gamma ray exposure rates, such as those due to fallout and natural background external gamma exposure rates at a height of 1 meter above the soil surface. It measures and records gamma exposure rates, and provides a readout in microRoentgen/hour (µR/hr).

2.8 Reproducible Geometry - A spatial configuration of a radiation detection instrument, in relation to a radiation source, that is specified in sufficient detail to allow each source check performed to obtain comparable results.

2.9 Scintillation Detector or Counter - The combination of phosphor, photomultiplier tube, and associated electronic circuits for counting light emissions produced in the phosphor by ionizing radiation.

2.10 Shall - The word shall denote a requirement.

2.11 Should - The word should is used when an element is recommended.

2.12 Sodium Iodide (NaI) Detector - A scintillation crystal which is effective in the detection of gamma radiation.

3.0 RESPONSIBILITIES AND QUALIFICATIONS

3.1 IT Project Manager - The IT Project Manager is responsible for assuring the implementation of this procedure during the performance of project activities.

3.2 Quality Assurance Officer - The Quality Assurance Officer is responsible for approving this procedure and performing surveillances to verify compliance with this procedure.

3.3 Sampling and Analysis Supervisor (SAS) - The SAS is responsible for following this procedure and assuring that requirements are met. The SAS shall select qualified personnel to perform this activity.

3.4 Field Personnel - Field personnel are responsible for meeting the requirements of this procedure and the Site-Specific Health and Safety Plan (SSHASP).

4.0 MATERIALS/EQUIPMENT AND CALIBRATION REQUIRED

4.1 Materials/Equipment

4.1.1 This procedure applies to the operation of all radiation detection instruments and equipment.

- Radiation check sources
- Field Activity Daily Log (FADL)
- Instrument Check Forms
- Instrument Quality Control Chart
- Corresponding Standard Operating Procedure (SOP) for the instruments being used
- Manufacturer's Operating Manual for instrument
- Hand held calculator.

4.2 Calibration Required

4.2.1 The instrument being used shall be calibrated at least annually and have a current calibration certificate.

4.2.2 Any instrument exceeding the stated calibration expiration date shall not be used and shall be tagged "out of service".

4.2.3 Operational and source checks shall be performed and recorded before and after an instrument is used.

5.0 METHOD

5.1 Daily Background Check

5.1.1 Background checks shall be performed as a minimum before and at the completion of daily field activities and as required by the SAS.

5.1.2 All detectors should be assembled in a predetermined area and position for consistency and control of measurements.

5.1.3 Set the instrument timer for a 1- and 10-minute integrated counts.

5.1.4 Begin monitoring or counting.

5.1.5 When the count is complete, record this number on the "Instrument Check Form" for the appropriate instrument (Attachments A through F).

5.2 Daily Source Check

5.2.1 Source checks should be performed before and at completion of daily field activities.

5.2.2 All detectors should be assembled in a predetermined area and position for consistency and control of measurements.

5.2.3 Place the appropriate calibration source in a reproducible geometry with the detector.

5.2.3.1 The identification of the calibration source is recorded on the appropriate "Instrument Check" form (Attachments A through F).

5.2.3.2 Verify that the timer is set for 1 and 10 minute counts.

5.2.3.3 Begin counting or measuring.

5.2.3.4 When the count is complete, remove the source.

5.2.3.5 Record the total source counts and count time on the "Instrument Check" form.

5.2.3.6 Plot the net source counts on the appropriate "Instrument Quality Control Chart" (see SOP-CHR-14).

5.2.4 Daily Efficiency Check

5.2.4.1 The efficiency is determined by taking the source count rate (source counts divided by count time in cpm) and subtracting the background count rate (background counts divided by count time). Divide this number by the known source strength in disintegrations per minute (dpm). Multiply by 100 to get % efficiency.

$$\text{Efficiency}\left(\frac{\text{cpm}}{\text{dpm}}\right) = \frac{\text{source (cpm)} - \text{background (cpm)}}{\text{source strength (dpm)}}$$

$$\%\,\text{Efficiency} = \text{Efficiency}\left(\frac{\text{cpm}}{\text{dpm}}\right) \times 100$$

5.2.4.2 Record the efficiency on the Instrument Field Form.

5.3 Calculations

5.3.1 Net Count, in counts per minute (cpm) = Check Source (cpm) - Indoor Background (cpm).

5.3.2 Average net count rate ($\bar{x}$):

$$\bar{x} = \frac{1}{n_s} \sum_{i=1}^{n_s} x_i$$

Where:

n_s = number of individual net count rates used to determine $\bar{x}$.
$\bar{x}$ = calculated mean (average).
x_i = individual net count rate.
s = standard deviation.

5.3.3 Standard deviation (s):

$$s = \sqrt{\frac{\sum_{i=1}^{n_s} (\bar{x}-x_i)^2}{n-1}}$$

Where:

s = standard deviation

6.0 REQUIRED INSPECTION/ACCEPTANCE CRITERIA

6.1 If net source count value falls within ±2 standard deviations (σ) of the mean, the instrument is within the warning limits. No further action is required.

6.2 If the value falls outside ±2σ, obtain a second count by performing the steps described above. Plot both values using different representations for the points (i.e., dots for first values and x's for the second values).

6.3 If the second value falls outside ±2σ, but <±3σ, the instrument may be used. Eight consecutive points outside of ±2σ are cause for an investigation.

6.4 Instruments with values outside of $\pm 3\sigma$ cannot be used until an investigation and corrective actions are complete and will be tagged "out of service".

7.0 RECORDS

The following records generated as a result of implementation of this procedure shall be retained as quality records in accordance with DOE Order 1324.2A, Record Disposition and IT QA Program requirements.

7.1 Instrument Check Forms

7.2 Instrument Quality Control Chart

7.3 Field Activity Daily Log

8.0 REFERENCES

8.1 Requirements and Specifications

8.1.1 Instruction Manual for the Instrument

8.1.2 U.S. Department of Energy, Nevada Operations Office, July 1993, "Quality Assurance Project Plan," *Project Chariot: 1962 Tracer Study Site Assessment and Remedial Action Plan*, Appendix A, DOE/NV/93-085, Las Vegas, Nevada.

8.2 Related Procedures

8.2.1 SOP-CHR-11, Exposure Rate Measurements Using PIC

8.2.2 SOP-CHR-14, Operation of Multichannel Analyzer

8.2.3 SOP-CHR-15, Operation of Mobile Sodium-Iodide Detector System

8.2.4 SOP-CHR-26, Smear Sample Collection and Analysis

8.2.5 SOP-CHR-27, Operation of the Geiger-Mueller (Pancake) Detector and Survey Meter

8.2.6 SOP-CHR-28, Operation of the Alpha Scintillation Probe and Count Rate Meter

8.3 Others

None

9.0 ATTACHMENTS

9.1 Attachment A - Smear Counter Instrument Check Form

9.2 Attachment B - PIC Instrument Check Form

9.3 Attachment C - NaI Instrument Check Form

9.4 Attachment D - MCA Instrument Check Form

9.5 Attachment E - Alpha Scintillation Instrument Check Form

9.6 Attachment F - Geiger-Mueller Instrument Check Form

ATTACHMENT A

SMEAR COUNTER INSTRUMENT CHECK FORM
(Page 1 of 1)

Instrument Manufacturer ____________________
Scaler Model ____________________ Serial No. ____________________
Detector Model ____________________ Serial No. ____________________

Source ID__________ Isotope________ Activity __________as of ____________________
Source ID__________ Isotope________ Activity __________as of ____________________

DATE	BACKGROUND			SOURCE				EFF	Initials
	Total Counts	Count Time (min)	cpm	Total Counts	Count Time (min)	cpm	Net Count[a] cpm	cpm / dpm	

[a]Net Count (cpm) = Source value (cpm) - Background (cpm). Record this value on the Instrument Quality Control Chart.

ATTACHMENT B

PIC INSTRUMENT CHECK FORM
(Page 1 of 1)

Instrument Manufacturer ____________ Model No. ____________ Serial No.______________

Source ID ____________ Isotope ____________ Activity ____________ as of ____________

Date	Battery Response	Count Time	Background (µR/hr) Indoor	Background (µR/hr) Outdoor	Cesium Check Source (µR/hr)	EFF $\left(\frac{\mu R/hr}{\mu Ci}\right)$	Net Count[a] (µR/hr)	Initials

[a] Net Count (µR/hr) = Source value (µR/hr) - Indoor Background (µR/hr). Record this value on the Instrument Quality Control Chart.

ATTACHMENT C

NaI INSTRUMENT CHECK FORM

(Page 1 of 1)

INSTRUMENT MANUFACTURER ________________

SCALER MODEL ____________________________ SERIAL NO. ________________________________

DETECTOR MODEL __________________________ SERIAL NO. ________________________________

SOURCE ID __________________ ISOTOPE ___________________ ACTIVITY ___________________ AS OF _______

Date	Battery Response	Count Time	Background (cpm) Indoor	Background (cpm) Outdoor	Cesium Check Source (cpm)	EFF (cpm/dpm)	Net Count[a] (cpm)	Initials

[a] Net Count (cpm) = Source Value (cpm) - Indoor Background (cpm). Record this value on the Instrument Quality Control Chart.

ATTACHMENT D

MCA INSTRUMENT CHECK FORM
(Page 1 of 1)

INSTRUMENT MANUFACTURER ________________

MCA MODEL NO. ________________ SERIAL NO. ________________

DETECTOR MODEL ________________ SERIAL NO. ________________

SOURCE ID ________ ISOTOPE ________ ACTIVITY ________ AS OF ________
SOURCE ID ________ ISOTOPE ________ ACTIVITY ________ AS OF ________

Date	Battery Response	Count Time	Background Indoor	Background Outdoor	Cs-137 Total Counts	Total Counts	EFF (cpm/dpm)	Net Count[a] (cpm)	Initials

[a] Net Count (cpm) = Source Value (cpm) - Indoor Background (cpm). Record this value on the Instrument Quality Control Chart.

ATTACHMENT E

ALPHA SCINTILLATION INSTRUMENT CHECK FORM
(Page 1 of 1)

INSTRUMENT MANUFACTURER ______________

SCALER MODEL ______________ SERIAL NO. ______________

DETECTOR MODEL ______________ SERIAL NO. ______________

SOURCE ID ______________ ISOTOPE ______________ ACTIVITY ______________ AS OF ______

Date	Battery Response	Count Time	Background (cpm) Indoor	Background (cpm) Outdoor	Cesium Check Source (cpm)	EFF (cpm/dpm)	Net Count[a] (cpm)	Initials

[a] Net Count (cpm) = Cesium Value (cpm) - Indoor Background (cpm). Record this value on the Instrument Quality Control Chart.

ATTACHMENT F

GEIGER-MUELLER INSTRUMENT CHECK FORM
(Page 1 of 1)

INSTRUMENT MANUFACTURER ________________

SCALER MODEL ____________________________ SERIAL NO. ________________________________

DETECTOR MODEL __________________________ SERIAL NO. ________________________________

SOURCE ID ________________ ISOTOPE ________________ ACTIVITY ________________ AS OF _______

Date	Battery Response	Count Time	Background (cpm) Indoor	Background (cpm) Outdoor	Cesium Check Source (cpm)	EFF (cpm/dpm)	Net Count[a] (cpm)	Initials

[a] Net Count (cpm) = Cesium Value (cpm) - Indoor Background (cpm). Record this value on the Instrument Quality Control Chart.

INTERNATIONAL
TECHNOLOGY
CORPORATION

ITLV

STANDARD OPERATING PROCEDURE

NUMBER: CHR-19

TITLE: **Establishment of a Hexagonal Grid System for Mound Excavation**

APPROVED: ____ ITLV Program Manager **DATE:** 7/9/93

APPROVED: ____ ITLV Project Manager **DATE:** 7-9-93

APPROVED: ____ ITLV Quality Assurance Officer **DATE:** 7-9-93

CONTROLLED COPY NO. : ____

Revision No.	Date

TABLE OF CONTENTS

1.0 SCOPE AND OBJECTIVE

1.1 Scope - This procedure applies to the soil disposal mound excavation sampling grid. This procedure can be used for all shapes and sizes of an area that requires sampling.

1.2 Objective - The objective of this procedure is to provide guidelines for choosing soil sampling locations that will fulfill the post-excavation sampling objective: to verify that the excavation of the mound has been accomplished to the point that acceptable "clean" levels have been reached. Sampling all of the points on the grid will result in a 98 percent confidence level that the soil of concern has been removed. This process will be employed for both the on-site field screening sampling and the "clean" closure sampling effort.

2.0 DEFINITIONS

2.1 Grid - System of coordinates established on a site for purposes of referencing survey locations. Also known as Reference Grid System.

3.0 RESPONSIBILITIES AND QUALIFICATIONS

3.1 IT Project Manager - The IT Project Manager is responsible for assuring the implementation procedure during the performance of project activities.

3.2 Sampling and Analysis Supervisor (SAS) - The SAS is responsible for the implementation of this procedure. The SAS shall select qualified personnel to perform this activity.

3.3 Quality Assurance Officer - The Quality Assurance Officer is responsible for approving this procedure and performing surveillances to verify compliance with this procedure.

3.4 Field Personnel - Field Personnel are responsible for meeting the requirements of this procedure and the Site Specific Health and Safety Plan (SSHASP).

4.0 MATERIALS/EQUIPMENT AND CALIBRATION REQUIRED

4.1 Material/Equipment

- Graph paper
- Tape measures (2)
- Ruler
- Pencils
- Field Activity Daily Logs
- Indelible ink pens
- Survey flags or stakes
- Water proof markers

4.2 Calibration Required

The tape measure to be used to measure the excavation site shall be calibrated against a second tape measure prior to commencement of field work to ensure measurement accuracy.

5.0 METHOD

The following provides a summary of the step-wise procedures required to determine the locations of the grid sample points at the excavation.

5.1 Measure and Diagram the Excavation Site - The excavation site must first be measured using a tape measure. Draw the site to scale on graph paper.

5.2 Determine the Center and Radius of the Sampling Circle - The center and radius of the sampling circle is determined on a separate diagram as follows (see Attachment A for example of grid):

5.2.1 Draw the site diagram to scale.

5.2.2 Draw a line representing the longest dimension, (L_1), of the site diagram.

5.2.3 Find the midpoint of (P_1) of L_1.

5.2.4 Draw a second line, (L_2), perpendicular to L_1, through point P. Line L_2 must extend to the boundaries of the site.

5.2.5 Find the midpoint, (C), of the Line L_2. Point C is the center of the sampling circle. (In this example, points P and C coincide, but will not coincide for many other types of configurations.)

5.2.6 Measure the distance from point C to either end of L_1, which is the sampling radius (r). The distance, r, should be measured to the nearest 1/16 inch on the graph paper.

5.2.7 Scale the radius, r, up to actual size.

5.3 Find the Number of Grid Samples to be Used - Determine the number of samples to be taken in a hexagonal grid based upon the length of the sampling radius and the guidelines provided in Table 1.

Table 1
Sampling Radius/Number of Samples

Sampling Radius, r (feet)	Number of Samples
≤ 4	7
>4 - 11	19
>11	37

5.4 Plot the Sampling Points on the Site Diagram

5.4.1 The sampling points in a grid row shall be a distance, (s), apart; the grid rows shall be a distance, (u), apart. The distances s and u are determined from Table 2.

Table 2
Distances s and u

Distance, u, Between Number of Samples	Distance, s, Between	
	Adjacent Sample Points	Adjacent Rows
7	0.87 r	0.75 r
19	0.48 r	0.42 r
37	0.30 r	0.26 r

5.4.2 The center point of the grid shall lie on the center, (C), of the sampling circle. Construct the hexagonal grid and superimpose it over the site diagram (constructed on a second piece of graph paper). The middle row of the grid (points 1 through 7) should be oriented to maximize the number of sample points which lie within the boundaries of the clean-up site.

5.4.3 It should be noted that adjacent rows are staggered, and that the sample points of one row are located midway (horizontally) between the sample points of the other row.

5.5 <u>Mark the Sample Points on the Site</u>

5.5.1 Starting at the center, (C), of the clean-up site, mark the middle row points at the specified distance, r. Locate the adjacent rows a distance, u, from the middle row, and mark the sample points in each of these rows a distance, r apart. Complete the site sampling grid with sample points from the other two rows. Temporary numbered reference markers will be installed at all sampling points.

5.5.2 Discrete samples shall be collected from each sampling point that is located within the excavation boundaries and submitted for on-site field screening analysis. The procedure for collecting the sample by hand trowel or hand auger is presented in SOP-CHR-10, Surface Soil Sampling.

5.6 Completion of Field Screening Effort - At the completion of the on-site field screening effort, if all sample locations results did not equal or exceed the defined action levels, samples for "clean" closure purposes shall be collected. The same grid system (i.e., sample locations) employed for the on-site field screening effort shall be employed for this effort. However, the site will be evenly divided into four quadrants. Discrete samples shall be collected from sample points per quadrant and then composited as one. Thus, one composite sample per quadrant shall be submitted for analysis. One duplicate shall also be submitted for quality control. Additional information on collection of samples per quadrant is presented in Chapter 3 of the Sampling and Analysis Plan.

5.7 Information Recording - The sampler shall record all of the required information regarding the sample grid and sampling locations on the graph paper containing the grid drawings.

6.0 REQUIRED INSPECTION/ACCEPTANCE CRITERIA

Criteria for establishing the grid shall be based on EPA, 1988, used as best engineering practice.

7.0 RECORDS

The following records, generated as a result of implementation of this procedure, shall be retained as quality records in accordance with DOE Order 1324.2A, Record Disposition and IT QA Program requirements.

7.1 Field Activity Daily Log

7.2 Scaled grid drawings illustrating sample locations

8.0 REFERENCES

8.1 Requirements and Specifications

EPA, 1988, Field Manual for Grid Sampling of PCB Spill Sites to Verify Cleanup, EPA/560/5-86-107, Washington, DC.

8.2 Related Procedures

SOP-CHR-10, Surface Soil Sampling

8.3 Other

None

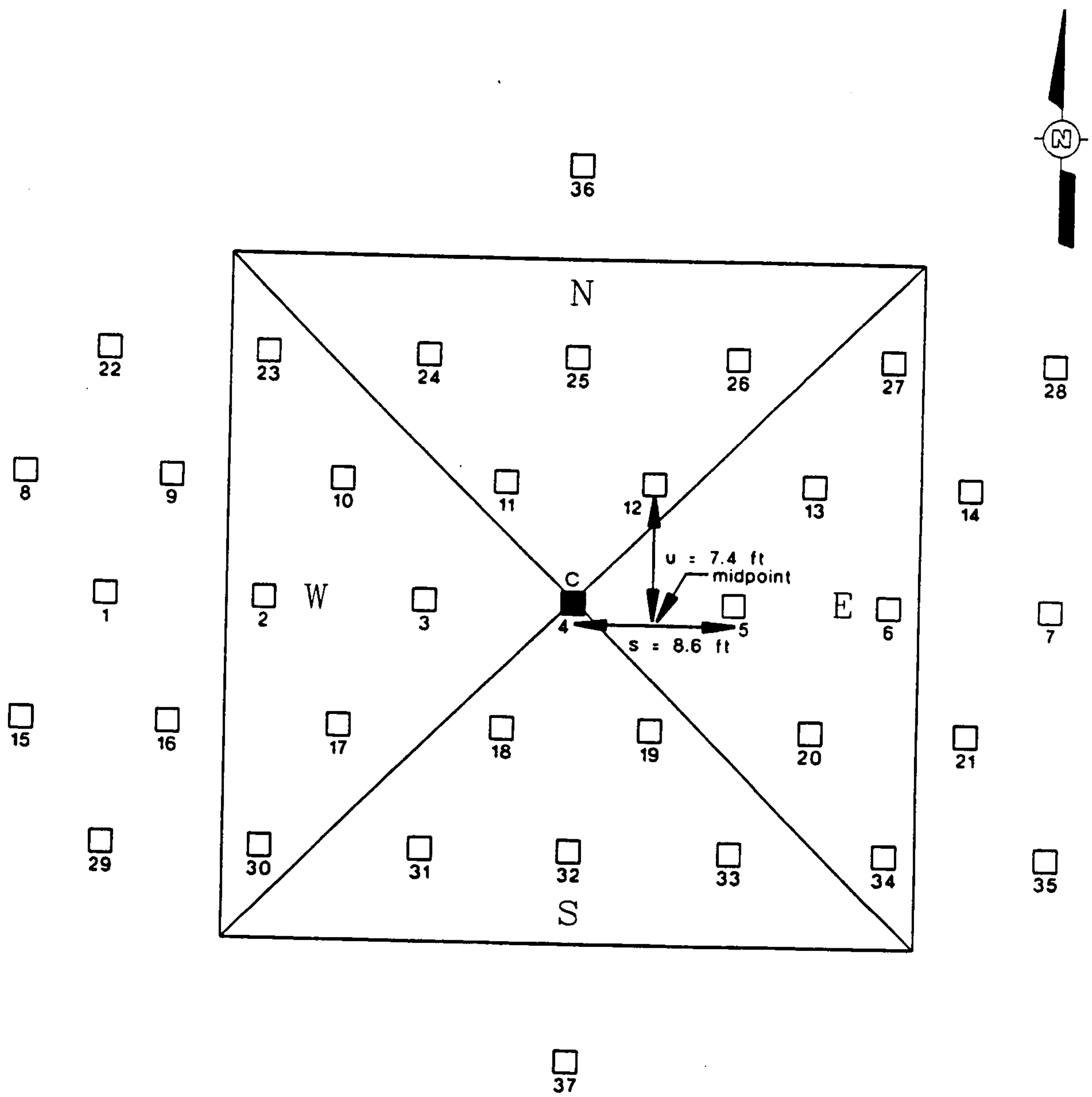
9.0 ATTACHMENTS

Attachment A - Example of Hexagonal Grid

INTERNATIONAL
TECHNOLOGY
CORPORATION

ATTACHMENT A

EXAMPLE OF HEXAGONAL GRID
(Page 1 of 1)



INTERNATIONAL
TECHNOLOGY
CORPORATION

ITLV

STANDARD OPERATING PROCEDURE

NUMBER: CHR-20

TITLE: **Small Mammal Sampling**

APPROVED: ______________________ **DATE:** 7/9/93
ITLV Program Manager

APPROVED: ______________________ **DATE:** 7-9-93
ITLV Project Manager

APPROVED: ______________________ **DATE:** 7-9-93
ITLV Quality Assurance Officer

CONTROLLED COPY NO. : _____

Revision No.	**Date**

TABLE OF CONTENTS

1.0 SCOPE AND OBJECTIVE

1.1 Scope - This procedure applies to the collection of small mammals from the Ogotoruk and Kisimilok Creek Valleys, for the purpose of radiological analysis.

1.2 Objective - The objective of this SOP is to establish a standard methodology for small mammal tissue collection. The SOP should be consulted during execution of the Field Sampling Plan (FSP).

Small mammals are an important component of ecological investigations and contaminant pathway analyses because they (1) are generally abundant and easily captured; (2) occupy small home ranges and thus reflect habitat quality or contamination of a specific area; (3) live in intimate contact with the soil and thus are maximally exposed to surficial contaminants; (4) include species with a wide range of diets, including leafy tissue, seeds, and invertebrates; and (5) are a primary prey component for a variety of predators, including weasels, foxes, coyotes, owls, hawks, kestrels, and snakes.

2.0 DEFINITIONS

Small mammals - The term "small mammals" refers primarily to various species of rodents in the following families: Cricetidae - New World rats and mice; Muridae - Old World rats and mice; Heteromyidae - pocket mice and kangaroo rats; and Zapodidae - jumping mice. In a broader sense, the term is also applied to shrews (Soricidae), pocket gophers (Geomyidae), and smaller ground squirrels (Sciuridae). At the Project Chariot Site, the small mammals of interest will include Tundra Redback, Tundra, and Alaska voles (Clethrionomys rutilus, microtus oeconomus, and microtus miurus), Greenland Collared and Brown lemmings (Discrostonyx greenlandeus and Lemmus trimucronatus), and arctic ground squirrels (Citellus parryi).

3.0 RESPONSIBILITIES AND QUALIFICATIONS

3.1 IT Project Manager - The IT Project Manager is responsible for assuring the implementation of this procedure during the performance of project activities.

3.2 Sampling and Analysis Supervisor (SAS) - The SAS is responsible for ensuring that this activity is performed in accordance with the requirements established in this procedure. The SAS shall select qualified personnel to perform this activity.

3.3 Quality Assurance Officer - The Quality Assurance Officer is responsible for approving this procedure and performing surveillances to verify compliance with this procedure.

3.4 Field Personnel - Field personnel are responsible for meeting the requirements of this procedure and the Site-Specific Health and Safety Plan (SSHASP). Personnel executing the protocols described in this SOP should be instructed in the use of the sampling apparatus and proper identification of species likely to be encountered. At least one person on each field crew should have a minimum of a four-year degree in Biology and two years of experience in conducting small mammal studies.

4.0 MATERIALS/EQUIPMENT AND CALIBRATION REQUIRED

- Havahart™ traps for ground squirrels (12)
- Museum Special traps for voles and lemmings (48)
- Pesola scale or equivalent (100 grams by 1 grams)
- Bait (see Section 5.3.2)
- Stiff brush and squirt bottle
- 25- or 50-meter (m) fiberglass tape measure
- Clear plastic bags (Ziploc® 1 and 2 gallon)
- Glass sample jars
- Field identification guide
- Bound field notebook and waterproof pens
- Field data forms, labels, chain of custody forms
- .22 caliber pistol and shells
- Dry ice for shipping
- Clear packing tape
- USGS 1:63,360 scale topographic maps
- Backpacks (2)
- Hemostats (2)
- Enameled dissecting pans (approximately 8- by 18-inches)
- Blue ice® or equivalent
- Compass

- Cooler
- Surgical scissors

5.0 METHOD

5.1 Preparation

5.1.1 Field Office

5.1.1.1 Review the SOPs listed in Section 8.0 and the SSHASP.

5.1.1.2 Coordinate schedules/actions with the field staff.

5.1.1.3 Assemble the equipment and supplies listed in Section 4.0. Verify the proper operation of all sampling equipment.

5.1.1.4 Notify the laboratory of sample types, the number of samples, and the approximate arrival date.

5.1.2 Documentation

5.1.2.1 Obtain and start a Field Activity Daily Log (FADL). (See SOP-CHR-01, Field Activity Daily Log.)

5.1.2.2 Obtain a sufficient number of the appropriate data collection forms (i.e., Biological Sample Collection Logs and Chain-of-Custody/Request for Analysis [COC/RFA] Forms). (See SOP-CHR-01, Custody/Request for Analysis Form.)

5.1.3 Field - Field preparation requires organizing sample containers, sample labels, and documentation in an orderly, systematic manner that promotes consistency and traceability of all data. Record all pertinent information (data, site name, ID number, and location) on the FADL and appropriate forms. Note field conditions, unusual circumstances, and weather conditions.

5.2 General Considerations and Limitations - Because small mammals are inconspicuous and mostly nocturnal, trapping is the only practical method for collecting tissue samples for species such as lemmings, voles, and ground squirrels.

The capture success of small mammals may be influenced by a number of variables other than those under the control of the investigator (e.g., trap placement, trap sensitivity, and bait). Such environmental variables include temperature, wind speed, cloud cover, timing relative to reproductive cycles, and amount of available food.

5.3 Baiting and Setting the Traps - Trap grids or lines will be located and oriented as specified in the FSP and established on the first day of trapping, using a 25-m or 50-m fiberglass tape measure. Once the grid or line has been established, the traps will be baited and set as described below. Each trap will be handled and set in the same manner, as follows:

5.3.1 Check for debris, such as dried feces, that could interfere with the mechanism, and remove any such debris.

5.3.2 Traps will be baited with a mixture of oatmeal and peanut butter (50/50) and all traps will be placed on an even surface, and, if possible, near naturally occurring cover.

5.4 Checking and Re-setting the Traps

5.4.1 Periods of darkness will be limited to one to three hours in the project region during the sampling effort. Therefore, traps will be set at times considered appropriate by the sampling team and checked approximately every 12 hours thereafter.

5.4.2 If a trap is snapped and contains an animal, the animal will be placed into a clear plastic bag for weighing, marking, and visual inspection. The trap should be cleaned, baited and re-set if diurnal species are being sought.

5.4.3 If a trap is snapped but does not contain an animal, this may indicate that the trap was set too sensitively and closed before the animal fully entered. Adjust the mechanism before proceeding to the next trap.

5.4.4 Ground squirrels will be trapped in Havahart™ live traps. Because of the potential for rabies, live animals will not be handled but will be dispatched in the trap with a .22 caliber pistol. The specimens will then be placed in individual labeled plastic bags and processed per Step 5.5. Non-target species will be released unharmed.

5.5 Weighing and Inspecting the Animals - After a captured animal has been transferred into a labelled clear plastic bag, it should be identified to genus (or species if possible), weighed to the nearest gram (g) while still in the bag using a Pesola scale or equivalent, and its sex and age class (adult vs. juvenile) determined. Age class will be determined based on size, pelage, and genitalia. If possible, the animal shall also be examined for reproductive status, condition of pelage, and presence of tumors or ectoparasites. Measurements, if required, shall include total body length and tail length, or other measurements as required by the Alaska Department of Fish & Game. Specimens will be processed according to the FSP, and frozen. The animals are to remain frozen during shipment for analysis.

5.6 The individually bagged specimen must be kept cool during transport to the field camp. Each specimen shall then be skinned, eviscerated, frozen, and shipped to the analytical laboratory.

Note: If split samples are required, organisms shall be homogenized per laboratory procedures and placed (divided) into the appropriate Ziploc® containers.

6.0 REQUIRED INSPECTION/ACCEPTANCE CRITERIA

Inspect sample collection containers for integrity; ensure that samples are properly frozen.

7.0 RECORDS

The following records, generated as a result of implementation of this procedure, shall be retained as quality records in accordance with DOE Order 1324.2A, Record Disposition and IT QA Program requirements.

7.1 Field Notebook

7.2 Field Activity Daily Log

7.3 Biological Sample Collection Log

7.4 Chain-of-Custody/Request for Analysis Form

7.5 Photodocumentation of sampling activities

8.0 REFERENCES

8.1 Requirements and Specifications

U.S. Department of Energy, Nevada Operations Office, July 1993, "Sampling and Analysis Plan," *Project Chariot: 1962 Tracer Study Site Assessment and Remedial Action Plan*, Appendix A, DOE/NV/93-085, Las Vegas, Nevada.

8.2 Related Procedures

8.2.1 SOP-CHR-01, Sample Control and Documentation

8.2.2 SOP-CHR-02, General Field Instructions

8.2.3 SOP-CHR-04, Field Decontamination

8.2.4 SOP-CHR-06, Field Activity Photographs

8.2.5 SOP-CHR-09, Shipment of Samples

8.2.6 SOP-CHR-30, Splitting Samples

8.3 Other

8.3.1 Burt, W. H. and R. P. Grossenheider, 1980, *Peterson Field Guides to the Mammals*, Houghton Mifflin Co., Boston.

8.3.2 U.S. Environment Protection Agency (EPA), 1989, *Risk Assessment Guidance for Superfund - Environmental Evaluation Manual, Interim Final (March)*, EPA/540/1-89/001A, Office of Emergency and Remedial Response, Washington, DC.

8.3.3 Whitaker, J.O., 1980, *The Audobon Society Field Guide to North American Mammals*, Alfred A. Knopf, New York.

9.0 ATTACHMENTS

Attachment A - Biological Sample Collection Log

ATTACHMENT A

BIOLOGICAL SAMPLE COLLECTION LOG
(Page 1 of 1)

Biological Sample Collection Log

Project ID ______________ Sample No. ______________

Location ______________ Code No. ______________

Collection Date ________ Time ________ Day of Year ______ Area Sampled ________ Volume Sampled ________

Sample Type ______________

Field Notes ______________

Signature:

Sample Sec.	Field Wet Wt.	Lab. Wet Wt.	Air Dry Wt.	Square Meter
(1)				
(2)				
(3)				
Initials/Date				

________ ml of H_2O added

Ratios: Lab. Wet/Lab. Wet + H_2O ________

Field Wet/Air Dry ________ Lab. Wet/Air Dry ________

WEIGHTS OF MUFFLED SAMPLE

Wet		Air Dry	Weight of Ash
(1)	Gross		
	Tare		
	Net		
	Corrected Weight		
(2)	Gross		
	Tare		
	Net		
(3)	Gross		
	Tare		
	Net		
(4)	Gross		
	Tare		
	Net		
(5)	Gross		
	Tare		
	Net		
TOTAL WEIGHT			

STANDARD WEIGHT DETERMINATION

Wet Sample Aliquot (~13g wet tissue, ~3.5g bone)

Wet / Std. Ash ________ = ________

Gross ________
Tare ________
Net ________
Corrected Net ________ Initials/date ________

Air Dry Sample Aliquot (~4g)

Gross ________
Tare ________
Net ________

Standard Dry Weight

Std. Dry / Air Dry ________ = ________

Gross ________
Tare ________
Net ________ Initials/date ________

Standard Ash Weight

Std. Dry / Wet ________ = ________

Gross ________
Tare ________
Net ________ Initials/date ________

Counted Sample Container # ________ # ________ # ________

	Wet	Dry	Ash
Gross			
Tare			
Net			

Process Remarks: ______________

INTERNATIONAL
TECHNOLOGY
CORPORATION

ITLV

STANDARD OPERATING PROCEDURE

NUMBER: CHR-21

TITLE: **Ptarmigan Sampling**

APPROVED: Joseph L. Yeasted DATE: 7/9/93
ITLV Program Manager

APPROVED: Andrea M. Hopf DATE: 7-9-93
ITLV Project Manager

APPROVED: Cheryl D. Prince DATE: 7-9-93
ITLV Quality Assurance Officer

CONTROLLED COPY NO. : _____

Revision No.	**Date**

TABLE OF CONTENTS

1.0 SCOPE AND OBJECTIVE

1.1 Scope - This procedure applies to the collection of Ptarmigan from locations in the Ogotoruk and Kisimilok Valleys for radiological screening in response to requests of North Slope Borough and residents.

1.2 Objective - The objective of this procedure is to establish a standard methodology for the collection of Ptarmigan or other game birds for the purpose of tissue analysis. Ptarmigan are an important component of contaminant pathway analysis because they are consumed by humans as well as predatory birds and mammals.

2.0 DEFINITIONS

Ptarmigan - An overwintering bird found in arctic regions, having white plumage in winter and dark plumage in summer as camouflage.

3.0 RESPONSIBILITIES AND QUALIFICATIONS

3.1 IT Project Manager - The IT Project Manager is responsible for assuring the implementation of this procedure during the performance of project activities.

3.2 Sampling and Analysis Supervisor (SAS) - The SAS is responsible for ensuring that this activity is performed in accordance with the requirements established in this procedure. The SAS shall select trained and experienced personnel to perform this activity.

3.3 Quality Assurance Officer - The Quality Assurance Officer is responsible for approving this procedure and performing surveillances to verify this procedure.

3.4 Field Personnel - Field personnel are responsible for meeting the requirements of this procedure and for the Site-Specific Health and Safety Plan (SSHASP). Personnel executing these protocols should have training and experience in the use of firearms. They must also be able to rapidly and positively identify the target species in the field.

At least one member of the field team should have a minimum of a BS or BA degree in biology and two years of experience in the collection of biological samples.

4.0 MATERIALS/EQUIPMENT AND CALIBRATION REQUIRED

- Shotgun, pump action, 12, 16, or 20 gauge
- Safety glasses or equivalent eye protection
- Field identification guide
- Shot shells of appropriate gauge, No. 6, 7-1/2 or 8 shot
- Ear plugs or muffs
- Clear plastic Ziploc® bags (15 by 15 inches minimum size)
- Bound field notebook and waterproof pens
- Field data forms, labels, chain-of-custody forms

5.0 METHOD

5.1 Preparation

5.1.1 Field Office

5.1.1.1 Review the SOPs listed in Section 8.0 and the SSHASP.

5.1.1.2 Coordinate schedules/actions with the field staff.

5.1.1.3 Assemble the equipment and supplies listed in Section 4.0. Verify the proper operation of all equipment.

5.1.1.4 Notify the laboratory of sample types, the number of samples, and the approximate arrival date.

5.1.1.5 Contact the carrier that will transport samples to determine that all information on regulations and specifications are met. Chain-of-Custody procedures shall be maintained.

5.1.2 Documentation

5.1.2.1 Obtain and complete a Field Activity Daily Log (FADL). (Example provided in SOP-CHR-01, Sample Control and Documentation).

5.1.2.2 Obtain a sufficient number of the appropriate data collection forms (i.e., Biological Sample Collection Logs and Chain-of-Custody/ Request for Analysis [COC/RFA] Forms). Examples of the log and form are provided in SOP-CHR-20, Small Mammal Sampling and SOP-CHR-01, Sample Control and Documentation, respectively.

5.1.3 Field

Field preparation requires organizing sample containers, sample labels, and documentation in an orderly, systematic manner that promotes consistency and traceability of all data. Record all pertinent information (date, site name, ID number, and location) on the FADL and appropriate forms. Note field conditions, unusual circumstances, and weather conditions.

5.2 Operation

Shooting is the most practical method for the collection of strong flying game birds such as Ptarmigan.

5.2.1 The shooter will walk ahead of other members of the sampling team, carrying the shotgun in a ready position, with the muzzle pointed upward. The shotgun should be loaded with field loads containing bird shot (No. 6, 7-1/2 or 8) and the safety shall be in the on or safe position.

5.2.2 When the target species is sighted, the safety will be placed on the off position, the shooter will attempt to approach to within 40 yards before firing.

In no case should shots at sitting or flying birds be attempted at distances of greater than 40 yards.

5.2.3 The field team will remain well behind the shooter during the approach and shot, and will assist in visually marking and retrieving downed birds. If birds flush and are missed, the field team will attempt to observe the flight and landing area so that a second approach can be made.

5.2.4 After firing, the safety shall be returned to the on position and the gun re-loaded.

5.2.5 Birds that are crippled will be retrieved and dispatched by compressing the chest cavity (grip the bird from the back behind the wings and squeeze firmly).

5.2.6 Specimens shall be placed in individually labeled plastic Ziploc® bags and kept cool during transport to the field camp, where weights, measurements, and identification will be entered in field logs and Chain-of-Custody/Request for Analysis Forms (See SOP-CHR-01, Sample Control and Documentation). Specimens will then be skinned, eviscerated, frozen, and shipped to the analytical laboratory.

5.2.7 The location where a bird is collected shall be marked on a topographic map and photographed.

5.2.8 Original forms and FADLs shall be given to the IT Project Manager for technical review. The Project Manager shall review and sign the forms, as appropriate, and submit them to the project central files at the completion of the project.

5.2.9 Inventory equipment and supplies. Repair or replace all broken or damaged equipment. Replace expendable items. Return equipment to the equipment manager and report incidents of malfunction or damage.

5.2.10 Contact the laboratory to verify that samples arrived safely and instructions for sample analyses are clearly understood. (Note: if split samples are required, organisms shall be homogenized per standard lab practices and then placed (divided) into the appropriate Ziploc® containers.)

6.0 REQUIRED INSPECTION/ACCEPTANCE CRITERIA

Inspect sample collection containers for integrity; insure that samples are properly frozen.

7.0 RECORDS

The following records, generated as a result of implementation of this procedure, shall be retained as quality records in accordance with DOE Order 1324.2A, Record Disposition and IT QA Program requirements.

7.1 Bound Field Logbook

7.2 Field Activity Daily Log

7.3 Biological Sample Collection Logs

7.4 Chain-of-Custody/Request for Analysis Form

7.5 Photodocumentation of Sampling Activities

8.0 REFERENCES

8.1 Requirements and Specifications

U.S. Department of Energy, Nevada Operations Office, July 1993, "Sampling and Analysis Plan," *Project Chariot: 1962 Tracer Study Site Assessment and Remedial Action Plan*, Appendix A, DOE/NV/93-085, Las Vegas, Nevada.

8.2 Related Procedures

8.2.1 SOP-CHR-01, Sample Control and Documentation

8.2.2 SOP-CHR-02, General Field Instructions

8.2.3 SOP-CHR-04, Field Decontamination

8.2.4 SOP-CHR-06, Field Activity Photographs

8.2.5 SOP-CHR-09, Shipment of Samples

8.2.6 SOP-CHR-20, Small Mammal Sampling

8.3 Other - None

9.0 ATTACHMENTS

None

INTERNATIONAL
TECHNOLOGY
CORPORATION

ITLV

STANDARD OPERATING PROCEDURE

NUMBER: CHR-22

TITLE: **Selection of Background Sampling Locations**

APPROVED: [signature] **DATE:** 7/9/93
ITLV Program Manager

APPROVED: [signature] **DATE:** 7-9-93
ITLV Project Manager

APPROVED: [signature] **DATE:** 7-9-93
ITLV Quality Assurance Officer

CONTROLLED COPY NO. : _____

Revision No.	**Date**

TABLE OF CONTENTS

1.0 SCOPE AND OBJECTIVE

1.1 Scope - This procedure provides instructions for the selection of background sampling locations.

1.2 Objective - The objective of this procedure is to provide a repeatable, auditable process for collection of soil samples and instrument readings at background sampling locations.

2.0 DEFINITIONS

2.1 May - The work may is used to denote permissibility.

2.2 Shall - The word shall denote a requirement.

2.3 Should - The word should is used when an element is recommended

3.0 RESPONSIBILITIES AND QUALIFICATIONS

3.1 IT Project Manager - The IT Project Manager is responsible for assuring the implementation of this procedure during the performance of project activities.

3.2 Quality Assurance (QA) Officer - The QA Officer is responsible for approving this procedure and performing surveillances to verify compliance with this procedure.

3.3 Sampling and Analysis Supervisor (SAS) - The SAS is responsible for implementing the radiological and soil sampling collection associated with this procedure. The SAS shall assign qualified personnel to perform this activity.

3.4 Field Personnel - Field personnel are responsible for meeting the requirements of this procedure and for meeting requirements of the Site-Specific Health and Safety Plan (SSHASP).

4.0 MATERIALS/EQUIPMENT AND CALIBRATION REQUIRED

4.1 Materials/Equipment

- Sodium Iodine (NaI) Detector (3- by 3-inch)
- Lead Shield for NaI Detector
- Eberline Model ESP-2 ratemeter
- Canberra Portable Multichannel Analyzer
- Soil Sampling Equipment (hand auger, hand trowels)
- Soil Sample Containers
- Survey stakes and/or flags
- Tape Measure.

4.2 Calibration

None

5.0 METHOD

5.1 Mound Area

5.1.1 Select a region as near the mound as possible having similar terrain and vegetation and an area of approximately 30- by 30-meters.

5.1.2 On a nearly square grid, place stakes every 10 meters for a total of nine stakes.

5.1.3 Obtain count rate readings at each location to ensure that area is uniform (see SOP-CHR-03).

5.1.4 Sample any seven of the locations in accordance with SOP-CHR-10. If any of the area appears contaminated, select a new background region.

5.1.5 Sampling shall include soils for laboratory analysis.

5.1.6 Radiation measurements will be made at each soil sample location with the MCA System and ESP-2 system (1 and 10 minutes each) in accordance with SOP-CHR-14 and SOP-CHR-15.

5.2 Three Remote Locations

5.2.1 Proceed to location chosen on map (see Plate 2 of the Site Assessment and Remedial Action Plan for background sampling locations).

5.2.2 On a nearly square grid (30- by 30-meters), place stakes every 10 meters for a total of nine stakes.

5.2.3 Obtain count rate readings at each location to ensure that area is uniform.

5.2.4 Sample any seven of the locations in accordance with SOP-CHR-10. If any of the area appears contaminated, select a new background region.

5.2.5 Sampling shall include soils for laboratory analysis.

5.2.6 Radiation measurements will be made at each soil sample location with the MCA System and ESP-2 system (1 and 10 minutes each) in accordance with SOP-CHR-14 and SOP-CHR-15.

6.0 REQUIRED INSPECTION/ACCEPTANCE CRITERIA

None

7.0 RECORDS

The following records, generated as a result of implementation of this procedure, shall be retained as quality records in accordance with DOE Order 1324.2A, Record Disposition and IT QA Program requirements.

7.1 Field Activity Daily Log (FADL)

8.0 REFERENCES

8.1 Requirements and Specifications

U.S. Department of Energy, Nevada Operations Office, July 1993, *Project Chariot: 1962 Tracer Study Site Assessment and Remedial Action Plan*, DOE/NV/93-085, Las Vegas, Nevada.

8.2 Related Procedures

8.2.1 SOP-CHR-01, Sample Control and Documentation

8.2.2 SOP-CHR-02, General Field Instructions

8.2.3 SOP-CHR-03, Walk-over Surveys using a Large Volume Scintillation Counter

8.2.4 SOP-CHR-04, Field Decontamination

8.2.5 SOP-CHR-06, Field Activity Photographs

8.2.6 SOP-CHR-10, Surface Soil Sampling

8.2.7 SOP-CHR-14, Operation of Multichannel Analyzer

8.2.8 SOP-CHR-15, Operation of Mobile Sodium-Iodide Detector System

8.3 Other

None

9.0 ATTACHMENTS

None

INTERNATIONAL
TECHNOLOGY
CORPORATION

ITLV

STANDARD OPERATING PROCEDURE

NUMBER: CHR-23

TITLE: **Global Positioning System**

APPROVED: Joseph G. Yeasted **DATE:** 7/9/93
ITLV Program Manager

APPROVED: [signature] **DATE:** 7-9-93
ITLV Project Manager

APPROVED: Cheryl D. Prince **DATE:** 7-9-93
ITLV Quality Assurance Officer

CONTROLLED COPY NO. : _____

REVISION NO.	**DATE**

TABLE OF CONTENTS

1.0 SCOPE AND OBJECTIVE

1.1 Scope - This Standard Operating Procedure (SOP) applies to activities for obtaining coordinates of grid nodes and sample locations at the Project Chariot Site using a global positioning system (GPS).

1.2 Objective - The objective of this SOP is to provide a standardized method for obtaining and documenting GPS coordinates to provide a permanent and accurate record of grid points and sampling locations.

2.0 DEFINITIONS

2.1 Coordinate - Any of a set of numbers used in specifying the location of a point on a line, on a surface, or in space.

2.2 Global Positioning System - A satellite-based navigation system that provides precise position, velocity, and time information. A typical GPS receiver (equipment) consists of an antenna, signal processing electronics, and processor. The primary function of the receiver is to acquire signals, recover orbital data, make range and Doppler measurements, and process this information in real-time to obtain the user position, velocity, and time.

2.3 Recorder - The individual who documents the data collection during field activities.

3.0 RESPONSIBILITIES AND QUALIFICATIONS

3.1 IT Project Manager - The IT Project Manager is responsible for assuring the implementation of this procedure during the performance of project activities.

3.2 Sampling and Analysis Supervisor - The Sampling and Analysis Supervisor (SAS) is responsible for implementing this procedure and selecting qualified field personnel adequately trained in the use of the equipment to perform this activity.

3.3 Field Personnel - Field personnel are responsible for meeting the requirements of this procedure and the Site-Specific Health and Safety Plan (SSHASP).

4.0 MATERIALS/EQUIPMENT AND CALIBRATION

4.1 Materials/Equipment

The following equipment and forms are required for the activities of this procedure:

- Navigational compass
- Fine-tip waterproof marker or pen
- Wristwatch or appropriate timepiece
- Measuring tape (with markings in both meters and feet) or surveyor's wheel
- Site markers
- GPS (two receiving units, carrying cases, portable antennae, extra battery packs, and any other necessary equipment or attachments as per manufacturer's instructions).
- Manufacturers operational manual for the GPS system
- GPS Field Survey Form
- Field Activity Daily Log

4.2 Calibration Required

Equipment shall be calibrated in accordance with manufacturer's instructions. Personnel shall ensure equipment calibration is current and perform operational checks prior to use.

5.0 METHOD

5.1 Data Collection

5.1.1 Using the GPS instrument, compute the windows of time when the satellite constellation is at the desired position to satisfy the specified parameters and ensure data availability.

5.1.2 Collection of data shall be performed in accordance with the manufacturer's operational manual.

5.1.3 The IT field recorder shall manually record the GPS data gathered during operation of the GPS equipment on the Global Positioning System Field Survey Form (Attachment A).

5.2 Data Storage

5.2.1 Field information gathered with the GPS is also instantaneously stored on the system's memory bank or datalogger. This information shall be downloaded and validated with appropriate GPS computer software. The information shall be saved onto appropriate disks from which a hard copy report of the GPS data shall be generated.

5.2.2 Disks shall be properly labeled with project name and number, dates on which the information was gathered, and dates field work was performed during data collection.

5.2.3 The disk data collected shall be considered the primary source of GPS data for the project. In the event that the disk data becomes invalid or ultimately unavailable, the GPS Field Survey Forms shall be considered the primary source of data collection.

6.0 REQUIRED INSPECTION/ACCEPTANCE CRITERIA

A State of Alaska licensed surveyor must review and concur with GPS data.

Note: The ultimate accuracy of GPS is determined by the sum of several sources of error. The contribution of each source may vary depending on ionospheric/atmospheric conditions, satellite clocks, receivers, multipath reception, and selective satellite availability produced by the U.S. Department of Defense.

7.0 RECORDS

The following records generated as a result of implementation of this procedure shall be retained as quality records in accordance with DOE Order 1324.2A, Record Disposition and IT QA Program requirements.

7.1 Field Activity Daily Log, as per SOP-CHR-01

7.2 Global Positioning System Field Survey Form

8.0 REFERENCES

8.1 Requirements and Specifications

None

8.2 Related Procedures

8.2.1 SOP-CHR-01, Sample Control and Documentation

8.2.2 SOP-CHR-12, Visual Inspection and Documentation of Test Plots

8.3 Others

GPS Equipment Manufacturer's Operational Manual

9.0 ATTACHMENTS

Attachment A - Global Positioning System Field Survey Form

ATTACHMENT A

GLOBAL POSITIONING SYSTEM FIELD SURVEY FORM
(Page 1 of 1)

GLOBAL POSITIONING SYSTEM
FIELD SURVEY FORM

AREA NUMBER: ______________________
SITE NAME: ______________________
SITE NUMBER: ______________________
GENERAL DESCRIPTION OF SITE: ______________________
GPS FIELD CREW: ______________________
GPS EQUIPMENT SERIAL NUMBER: ______________________

GPS POINT #1:
LOCATION: ______________________
TIME AND DATE: ______________________
LENGTH OF COORDINATE ACQUISITION (in minutes): ______________________

GPS POINT #   :
LOCATION: ______________________
TIME AND DATE: ______________________
LENGTH OF COORDINATE ACQUISITION (in minutes): ______________________

GPS POINT #   :
LOCATION: ______________________
TIME AND DATE: ______________________
LENGTH OF COORDINATE ACQUISITION (in minutes): ______________________

GPS POINT #   :
LOCATION: ______________________
TIME AND DATE: ______________________
LENGTH OF COORDINATE ACQUISITION (in minutes): ______________________

IT GPS FIELD CREW SIGNATURE: ______________________ DATE: __________

Notes: The acronym NA shall appear on any line where the information required does not apply. The acronym NF shall appear on any line where the information is not available or obtainable.

INTERNATIONAL
TECHNOLOGY
CORPORATION

ITLV

STANDARD OPERATING PROCEDURE

NUMBER: CHR-24

TITLE: **Vegetation Sampling**

APPROVED: Joseph Glerasted — ITLV Program Manager — **DATE:** 7/9/93

APPROVED: Andrea M. Hopf — ITLV Project Manager — **DATE:** 7-9-93

APPROVED: Cheryl D. Prince — ITLV Quality Assurance Officer — **DATE:** 7-9-93

CONTROLLED COPY NO. : _____

Revision No.	**Date**

TABLE OF CONTENTS

1.0 SCOPE AND OBJECTIVE

1.1 Scope - This procedure applies to the sampling of vegetation from Ogotoruk Creek Valley and Kisimilok Creek Valley to determine residual radionuclide concentrations for strontium-90 (Sr-90) and cesium-137 (Cs-137).

1.2 Objective - The objective of this procedure is to establish a standard method for the collection of lichens, herbaceous vascular plants, and shrubs that will provide representative samples of the actual site conditions, and provide current data that may be compared to past measurements.

2.0 DEFINITIONS

2.1 May - The word may is used to denote permissibility.

2.2 Shall - The word shall denotes a requirement.

2.3 Should - The word should is used when an element is recommended.

3.0 RESPONSIBILITIES AND QUALIFICATIONS

3.1 IT Project Manager - The IT Project Manager is responsible for assuring the implementation of this procedure during the performance of project activities.

3.2 Sampling and Analysis Supervisor (SAS) - The SAS is responsible for the implementation of this procedure. The SAS shall assign qualified personnel to perform this activity.

3.3 Quality Assurance Officer - The Quality Assurance Officer is responsible for approving this procedure and performing surveillances to verify compliance with this procedure.

3.4 Field Personnel - Field personnel are responsible for meeting the requirements of this procedure and for meeting requirements of the Site-Specific Health and Safety Plan (SSHASP).

4.0 MATERIALS/EQUIPMENT AND CALIBRATION REQUIRED

Field sampling supplies and equipment needed for collection of vegetation samples will include:

4.1 Materials/Equipment

- Pesola scale or equivalent (1,000 grams)
- Ziploc® bags (1 and 2 gallon)
- Clear packing tape
- Bound field notebook
- Camera and film
- Marker pens
- 2-meter steel tape
- Sample collection logs
- USGS 1:63,360 topo maps
- 19-inch hedge shears
- 1 bolt of cheesecloth
- Field Activity Daily Logs
- Chain-of-Custody/Request for Analysis (COC/RFA) Form
- Biological Sample Collection Log
- Compass
- 5 x 8 index cards
- Hammer (5-pound maul)
- Flags, surveyor tape, stakes
- Cooler or other container
- Felco pruning shears
- Cotton twine

4.2 Calibration Required

None

5.0 METHOD

5.1 Preparation

5.1.1 Field Office

5.1.1.1 Review the SOPs listed in Section 8.0, and the SSHASP.

5.1.1.2 Coordinate schedules/actions with the field staff.

5.1.1.3 Assemble the equipment and supplies listed in Section 4.0. Verify the proper operation of all sampling equipment.

5.1.1.4 Notify the laboratory of sample types, the number of samples, and the approximate arrival date.

5.1.2 Documentation

5.1.2.1 Obtain and complete a Field Activity Daily Log (FADL) per instructions provided in SOP-CHR-01, Sample Control and Documentation.

5.1.2.2 Obtain a sufficient number of the appropriate data collection forms per requirements of SOP-CHR-01.

5.1.2.3 Obtain copies of the Biological Sample Collection Log (see SOP-CHR-20, Small Mammal Sampling) and complete as information is obtained.

5.1.3 Field

Field preparation requires organizing sample bags, sample labels, and documentation in an orderly manner that promotes consistency and traceability of all data.

5.1.3.1 Before sampling, ensure that all sampling equipment is decontaminated according to SOP-CHR-04, Field Decontamination.

5.1.3.2 Record all pertinent information (date, site name, ID number, and location) on the FADL and the appropriate data forms. Note field conditions, unusual circumstances, and weather conditions.

5.2 Verifying and Marking Sample Stations

5.2.1 All landmarks must be permanent or securely fixed in place.

5.2.2 At least two landmarks are preferred so that station locations can be reproduced by triangulation.

5.2.3 Record brief descriptions of station locations, including relevant landmarks and coordinates from the 1:63.360 topographic map on the FADL.

5.2.4 Sketch the sample location with detailed information on the Biological Sample Collection Log.

5.2.5 Photograph the sampling station and include landmarks.

5.3 Collecting Vegetation Samples

5.3.1 Lichens

Four major types of lichen communities shall be sampled from six initial locations, as stipulated in the SAP. Three replicates of 200 to 500 grams wet weight must be collected from each location.

5.3.1.1 Representative samples of separate lichen species communities shall be collected by hand to separate various species and associated vascular plants. The lichens shall be plucked at ground level.

5.3.1.2 Samples must be representative of major communities, which often consist of a dominant species and several subordinate species. Each sample shall be composited into plastic bags, labeled, and kept cool until returned to the field camp.

5.3.1.3 Sample wet weight shall be measured by hanging the sample bag from the Pesola scale. It is estimated that 0.25 to 0.50 square meters (m^2) will be harvested to collect the mass required for analysis. Areal collections (on a square meter basis) shall be made in those situations where it appears plausible, in order to estimate biomass and inventory of radionuclides in various habitats. This will be determined in the field by the sampling team.

5.3.2 Herbaceous Vascular Plants

Sedges shall be sampled on an areal (square meter) basis that allows estimates of biomass and radionuclide inventory. Samples shall be obtained of three major sedge community types, (*Carex* wet meadow, *Eriophorum* tussock and *Eriophorum-Carex* wet meadow) at locations adjacent to the mound and at former study sites in the upper Ogotoruk Creek Valley. Samples of the *Dryas* fell-field community shall also be obtained.

Field collection will consist of staking square meters of a community type and clipping to ground level with hedge shears. Tussocks will be clipped individually and their area estimated using a steel tape. Three samples of 500 to 1,000 grams wet weight shall be collected from each location.

5.3.2.1 *Carex aquatilis*, the common sedge of wet meadows, will be the principal species collected. One or more square meters of this community may be collected in one plastic bag, making careful note of how many square meters were included, both on the bag Biological Sample Collection Form and COC/RFA forms.

The samples shall be placed in plastic bags, weighed using the Pesola scale, labeled, and kept cool until returned to the field camp. They must then be transferred to cheesecloth bags and allowed to dry. Prior to shipment, they shall be returned to their original plastic bags.

5.3.2.2 *Eriophorum vaginatum* tussocks shall also be sampled individually, representing about one-eighth m^2, and combined to provide sufficient biomass for radionuclide measurement. An estimate will be made of the areal extent of each sample and recorded on the forms and logs.

5.3.2.3 *Eriophorum angustifolium*, *E. russeolum*, and *E. scheuchzeri* occur with *Carex aquatilis* in the *Eriophorum-Carex* wet meadow community type at Chariot. Square-meter plots of all species included shall be sampled, combining one-meter samples in one bag as in Section 5.3.2.1.

5.3.2.4 The *Dryas* fell-field community type shall be sampled in the same manner as the *Eriophorum* tussock community, in that individual clumps will be combined to provide sufficient biomass for radionuclide measurement.

5.3.3 <u>Shrubs</u>

Samples from suspected contaminated areas shall be carefully collected, using nitrile gloves for individual samples. Sampling equipment will be wiped between samples, wipes screened with portable detection equipment, and all precautions taken to avoid cross-contamination. Sampling must be done prior to soil coring or other operations that may disturb the area and result in external contamination. Three samples of 1,500 to 2,000 grams wet weight will be collected at each location, as per the Sampling and Analysis Plan. The samples will be placed in plastic bags, weighed using the Pesola scale, labeled, and kept cool until returned to the field camp.

5.3.3.1 Willows of several species are the dominant shrubs of interest in the current studies. Current annual growth of feltleaf and other species of willow shall be collected. Willows of several species will be sampled by clipping terminal growth, which should contain mobilized radionuclides if they are present.

5.3.3.2 Ericaceous shrubs, such as Laborador tea (*Ledum decumbens*), four-angled cassiope (*Cassiope tetragona*), and several others are found in snow accumulation areas. These will be collected on an area basis so far as possible.

5.3.4 Secure the sample container label by applying clear plastic tape over the label (after ascertaining that the correct information has been transferred to the label) to avoid potential damage to the label or obliteration of information.

5.3.5 The Health and Safety Manager (HSM) or designee will survey the sample container and record the measurement on the appropriate forms.

5.3.6 Record all the applicable information regarding the sample (type, location, date, sampler's name) on the Biological Sample Collection Log.

5.3.7 Complete the COC/RFA form(s) for each sample per instructions of SOP-CHR-01.

5.3.8 Maintain custody of the samples by keeping the samples in actual possession, within view, locked up or sealed to prevent tampering, or placed in a secure area restricted to authorized personnel.

5.4 Post Operation

5.4.1 Field

5.4.1.1 Verify that all equipment is accounted for, and decontaminated (see SOP-CHR-04, Field Decontamination).

5.4.1.2 Make sure all sampling locations are properly marked and the location number is readily visible on the location marker.

5.4.2 Documentation

5.4.2.1 Record on the FADL those locations where sampling was performed.

5.4.2.2 Record on the Biological Sample Collection Log the specific sample collection information.

5.4.2.3 Complete daily log entries, verify the accuracy of entries, and sign/initial all pages.

5.4.2.4 Document the chain-of-custody on the COC/RFA form and review form for accuracy and completeness.

5.4.2.5 Review data collection forms for completeness.

5.4.3 Field Office

5.4.3.1 Deliver original forms, collection logs, and FADLs to the Sampling and Analysis Supervisor for technical review. The Project Manager shall then review and sign the forms, as appropriate, and submit them to the project files.

5.4.3.2 Inventory the equipment and supplies. Repair or replace all broken or damaged equipment. Replace expendable items. Return equipment to the equipment manager and report incidents of malfunction or damage.

5.4.3.3 Contact the laboratory to verify that samples arrived safely and that instructions for sample analyses are clearly understood.

5.5 Quality Control

5.5.1 Quality control samples at a rate of 20 to 30 percent shall be collected at the time of vegetation tissue collection, as per Table 4-1 of the SAP.

5.5.2 The quality control sampling program to be followed is described in the project-specific Sampling and Analysis Plan and Quality Assurance Project Plan.

6.0 REQUIRED INSPECTION/ACCEPTANCE CRITERIA

Sample collection containers shall be inspected for integrity, correct material composition, and correct amount required for the analyses to be performed.

7.0 RECORDS

The following records, generated as a result of implementation of this procedure, shall be retained as quality records in accordance with DOE Order 1324.2A, Record Disposition and IT QA Program requirements.

7.1 Field Activity Daily Log

7.2 Biological Sample Collection Log

7.3 Photodocumentation of sampling activities

7.4 Chain-of-Custody/Request for Analysis Form

8.0 REFERENCES

8.1 Requirements and Specifications

None

8.2 Related Procedures

8.2.1 SOP-CHR-01, Sample Control and Documentation

8.2.2 SOP-CHR-02, General Field Instructions

8.2.3 SOP-CHR-04, Field Decontamination

8.2.4 SOP-CHR-06, Field Activity Photographs

8.2.5 SOP-CHR-09, Shipment of Samples

8.2.6 SOP-CHR-20, Small Mammal Sampling

8.3 Other

None

9.0 ATTACHMENTS

None

INTERNATIONAL
TECHNOLOGY
CORPORATION

ITLV

STANDARD OPERATING PROCEDURE

NUMBER: CHR-25

TITLE: **Sampling of Fishes**

APPROVED: [signature] **DATE:** 7/9/93
ITLV Program Manager

APPROVED: [signature] **DATE:** 7-9-93
ITLV Project Manager

APPROVED: [signature] **DATE:** 7-9-93
ITLV Quality Assurance Officer

CONTROLLED COPY NO. : _____

Revision No.	**Date**

TABLE OF CONTENTS

1.0 SCOPE AND OBJECTIVES

1.1 Scope - This procedure applies to fish sampling to evaluate impairment and to assess levels of contaminants in tissues. The techniques described in this procedure may also be used for the collection of fish for species inventories.

1.2 Objective - The objective of this procedure is to provide instructions for the collection of fishes from aquatic habitats.

2.0 DEFINITIONS

2.1 Formalin - A clear aqueous solution of formaldehyde containing a small amount of methanol.

2.2 Lotic - Of, relating to, or living in actively-moving water.

2.3 Morphological - The form and structure of an organism or any of its parts.

2.4 Seine - A large net with sinkers on one edge and floats on the other that hangs vertically in the water and is used to enclose fish when its ends are pulled together or drawn ashore.

2.5 Taxonomic - The orderly classification of plants and animals according to their presumed natural relationships.

3.0 RESPONSIBILITIES AND QUALIFICATIONS

Personnel executing the protocols described below should be instructed in the use of the sample apparatus. At least one person of the field crew should have a minimum of a 4-year degree in biology, 2 years field experience in sampling aquatic biota, and the ability to field identify game and nongame fish species indigenous to the site. Personnel must also have met OSHA training requirements (40 C.F.R. 1910.120). All field procedures shall be performed in accordance with the respective QA/QC protocols and Health and Safety Plan.

3.1 IT Project Manager - The IT Project Manager is responsible for assuring the implementation of this procedure during the performance of project activities.

3.2 Sampling and Analysis Supervisor (SAS) - The SAS is responsible for the implementation of this procedure. The SAS shall select qualified personnel to perform this activity.

3.3 Quality Assurance Officer - The Quality Assurance Officer is responsible for approving this procedure and performing surveillances to verify compliance with this procedure.

3.4 Field Personnel - Field personnel are responsible for meeting the requirements of this procedure and the Site-Specific Health and Safety Plan (SSHASP).

4.0 MATERIALS/EQUIPMENT AND CALIBRATION REQUIRED

4.1 Materials/Equipment

- Haul seine nets
- Minnow traps
- Hip or chest waders
- Disposable gloves
- Coolers with ice
- Sample containers: teflon baggies, clean jars, or clean aluminum foil
- Fish measuring board
- Weighing equipment (water displacement method or hanging scale)
- Field notebook and waterproof pens
- Data sheets, labels, chain-of-custody forms
- Field identification guides
- Field Activity Daily Logs
- Fish Collection Log
- Tape measure

4.2 Calibration Required

None

5.0 METHOD

Fish are collected to evaluate impairment as indicated by differences in populations throughout streams and ponds, and form a comparison to potential baseline communities; provide information on the site-specific food web; identify fish species currently impacted or potentially impacted due to site specific conditions; and to assess levels of contaminants in tissues. The Field Sampling Plan (FSP), Table 4-1, indicates the species and number of specimens required for the specified analyses. The methods described in this SOP may be used for qualitative inventory of species, but are not meant to yield quantitative information on fish.

Observations and quantitative data collected during the implementation of these procedures shall be recorded in the field notebook or Field Activity Daily Log (FADL) forms and on the Fish Collection Log. Ongoing work at all stations shall also be photodocumented.

5.1 Sampling of Creeks and Ponds

The two collection methods described, seining and trapping with baited minnow traps, can be used in both ponds and lotic systems. Seining should be limited to habitats that are less than 1 meter deep, having low current velocity, and that are relatively free of vegetation, large rocks, and other submerged structures that may interfere with the seine. Minnow traps may be used in areas in which seines are not appropriate, but minnow traps are not appropriate in high current velocities.

5.1.1 Verifying Sample Station - A site visit shall be conducted prior to sampling. The field crew shall verify that conditions at the site are appropriate for sampling (i.e., if a stream site, verify that flow still exists). The reach of the creek or sections of the pond to be sampled shall be marked on a site map and by stakes at the site. If conditions at the site are inappropriate for sampling, the SAS shall be contacted.

5.1.2 Seining Method - Minnow seines (haul seines, 0.5 centimeter mesh) should be used in lotic systems. Seining should proceed upstream in 10 meter intervals until the designated reach has been covered. Unless otherwise specified in the

FSP, a creek interval shall not be sampled more than once. Shorelines of ponds may also be sampled with haul seines. Seine sweeps should proceed moving parallel to shore. The intensity of sampling should be standardized within and between sites by standardizing haul length to 10 meters.

5.1.3 Stationary Sampling Methods - Minnow traps may also be used to collect fish for inventory and/or tissue analysis. Fish shall be removed from such apparatus at least once in a 24-hour period. Gill nets may be used to collect fish from ponds. However, due to high mortality, gill nets should only be used when absolutely necessary and set for just enough time to collect the required sample. They shall not be used strictly for inventory purposes.

5.2 Handling of Samples

5.2.1 Fish to be returned to the water unharmed shall be placed in a live-well or equivalent until they can be processed. For each fish, weight, total weight, and sex (if possible), shall be recorded using the Fish Collection Log. If a fish is preserved for tissue analysis, eight to ten scales shall be removed from the mid-dorsal region above the lateral line. Scales shall be placed in a small vial and labeled with the sample number assigned to the fish. Scales shall then be submitted for aging of the fish. Note any observed deformities of fish on Fish Collection Logs. Release all fish not kept for subsequent tissue analysis.

5.2.2 Fish collected for tissue analysis shall be placed in clean teflon bags or aluminum foil and placed in a cooler with Blue Ice® or dry ice. Fish may be maintained in the cooler for no more than 4 hours before being taken to the laboratory (if local) or placed in a freezer at 0°F or colder overnight or until shipped. Fish field samples shall be shipped on dry ice.

5.2.3 Fish saved for taxonomic identification, morphological examination, or other examinations shall be preserved in ice-cold 10 neutral formalin. Larger fish may require injection of formalin into the body cavity for adequate preservation. Sampling tools, instruments, and other equipment shall be protected from sources of contamination before use and decontaminated after use in accordance with SOP-CHR-05, Field Decontamination.

5.2.4 Labeling, handling, and shipping of samples from tissue analysis shall be consistent with the Quality Assurance Project Plan (QAPjP). Quality assurance/quality control for the collection of analytical samples shall be accomplished by collection of arranged duplicates according to the QAPjP.

6.0 REQUIRED INSPECTION/ACCEPTANCE CRITERIA

Sample collection containers shall be inspected for integrity, correct material composition, the correct preservative, and correct amount required for the analyses to be performed.

7.0 RECORDS

The following records, generated as a result of implementation of this procedure, shall be retained as quality records in accordance with DOE Order 1324.2A, Record Disposition and IT QA Program requirements.

7.1 Fish Collection Log

7.2 Field Activity Daily Log, as per SOP-CHR-01, Sample and Control and Documentation

8.0 REFERENCES

8.1 Requirements and Specifications

8.1.1 Albert, R. and W. Horowitz. 1988. Coping with sample variability in biota: Percentiles and other strategies. In Principles of Environmental Sampling. L.H. Keith, Ed. American Chemical Society.

8.1.2 APHA. 1989. Standard Methods for the Examination of Wastewater. 1989. American Public Health Association, American Water Works Association, Water Pollution Control Federation, Washington, D.C.

8.1.3 Eddy, S. 1969. How to Know the Freshwater Fishes. Wm. C. Brown Co., Publ., Dubuque, Iowa.

8.1.4 EG&G Rocky Flats, Inc. 1991. Standard Operating Procedures: Field Operations 1.0.

8.1.5 EG&G Rocky Flats, Inc. 1991. Standard Operating Procedures: Surface Water 4.0.

8.1.6 EG&G Rocky Flats, Inc. 1990. Draft Environmental evaluation procedures for waste management areas at Rocky Flats (August). Prepared by Colorado State University, Fort Collins.

8.1.7 Smith, R.L. 1980. Ecology & field biology. Harper & Row, New York.

8.1.8 U.S. Environmental Protection Agency (EPA). 1987. A compendium of Superfund field operations methods. EPA, Washington, D.C. Office of Emergency and Remedial Response, Washington, D.C.

8.1.9 U.S. Environmental Protection Agency (EPA). 1989. Risk assessment guidance for Superfund -- Environmental Evaluation Manual. Interim Final (March). EPA/540/1-89-001A. Office of Emergency and Remedial Response, Washington, D.C.

8.2 <u>Related Procedures</u>

8.2.1 SOP-CHR-01, Sample Control and Documentation

8.2.2 SOP-CHR-05, Field Decontamination

8.3 <u>Others</u>

None

9.0 ATTACHMENTS

Attachment A - Fish Collection Log

ATTACHMENT A

FISH COLLECTION LOG
(Page 1 of 3)

FISH COLLECTION LOG

PROJECT NAME		PROJECT NO.
WATER BODY		DATE
STATION ID		TIME
STATION LOCATION	COLLECTION METHOD	SAMPLE NO.
		SHEET OF
		WATER QUALITY
		DISSOLVED OXYGEN
		TEMPERATURE
		CONDUCTIVITY
		pH
		SALINITY
		OXIDATION-REDUCTION POTENTIAL
		FLOW RATE DEPTH
		COMMENTS

Scientific Name	Common Name		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
		Length (mm)																									
		Weight (g)																									
		Comments																									
		Length (mm)																									
		Weight (g)																									
		Comments																									
		Length (mm)																									
		Weight (g)																									
		Comments																									
		Length (mm)																									
		Weight (g)																									
		Comments																									
		Length (mm)																									
		Weight (g)																									
		Comments																									
		Length (mm)																									
		Weight (g)																									
		Comments																									

ATTACHMENT A

FISH COLLECTION LOG
(Page 2 of 3)

FISH COLLECTION LOG
(Continuation)

PROJECT NAME	PROJECT NO.
WATER BODY	DATE
STATION ID	TIME
	SAMPLE NO.
	SHEET OF

Scientific Name	Common Name		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
		Length (mm)																									
		Weight (g)																									
		Comments																									
		Length (mm)																									
		Weight (g)																									
		Comments																									
		Length (mm)																									
		Weight (g)																									
		Comments																									
		Length (mm)																									
		Weight (g)																									
		Comments																									
		Length (mm)																									
		Weight (g)																									
		Comments																									
		Length (mm)																									
		Weight (g)																									
		Comments																									
		Length (mm)																									
		Weight (g)																									
		Comments																									
		Length (mm)																									
		Weight (g)																									
		Comments																									
		Length (mm)																									
		Weight (g)																									
		Comments																									
		Length (mm)																									
		Weight (g)																									
		Comments																									

ATTACHMENT A

FISH COLLECTION LOG
(Page 3 of 3)

FISH COLLECTION LOG

SEXUAL STATUS
- F - female
- Fg - gravid female
- M - male
- J - juvenile

HISTOPATHOLOGY
- BL - blind
- BD - tumor located dorsally on body
- BV - tumor located ventrally on body
- HD - tumor located dorsally on head
- HV - tumor located ventrally on head
- OD - tumor located dorsal at oral opening
- OV - tumor located ventrally at oral opening
- OA - occular abnormality
- SD - spinal deformity

OTHER
- * - sample archived

PHYSICAL CONDITION
- EF - eroded fins
- EM - excessive mucous
- EP - excessive external parasites
- FP - fungus present
- PC - poor condition overall
- RC - reddening color
- UP - ulcers present

ADDITIONAL COMMENTS

ARCHIVED SAMPLES

INTERNATIONAL
TECHNOLOGY
CORPORATION

ITLV

STANDARD OPERATING PROCEDURE

NUMBER: CHR-26

TITLE: Smear Sample Collection and Analysis

APPROVED: *[signature]* **DATE:** 7/9/93
ITLV Program Manager

APPROVED: *[signature]* **DATE:** 7-9-93
ITLV Project Manager

APPROVED: Cheryl D. Prince **DATE:** 7-9-93
ITLV Quality Assurance Officer

CONTROLLED COPY NO. : _____

REVISION NO.	**DATE**

TABLE OF CONTENTS

1.0 SCOPE AND OBJECTIVES

1.1 Scope - This procedure specifies the requirements for smear collection and analysis at the Project Chariot Site, Alaska.

1.2 Objective - The objective of this procedure is to provide a method for using filter paper/cloth smears and analyzing them in the Ludlum Model 2929/43-10-1 smear counter.

2.0 DEFINITIONS

2.1 May - The word may is used to denote permissibility.

2.2 Shall - The word shall denotes a requirement.

2.3 Should - The word should is used when an element is recommended.

2.4 Smear Survey - Consists of swiping a suspected contaminated area with a piece of filter and then measuring the activity on the paper.

3.0 RESPONSIBILITIES AND QUALIFICATIONS

3.1 IT Project Manager - The IT Project Manager is responsible for assuring the implementation of this procedure during the performance of project activities.

3.2 Sampling and Analysis Supervisor (SAS) - The SAS is responsible for the implementation of this procedure. The SAS shall select qualified personnel to perform this activity.

3.3 Quality Assurance Officer - The Quality Assurance Officer is responsible for approving this procedure and performing surveillances to verify compliance with this procedure.

3.4 Field Personnel - Field personnel are responsible for meeting the requirements of this procedure and the Site-Specific Health and Safety Plan (SSHASP).

4.0 MATERIALS/EQUIPMENT AND CALIBRATION REQUIRED

4.1 Material/Equipment

- Ludlum Model 2929/43-10-1 Dual Channel Smear Counter, or equivalent
- Paper/cloth smears
- Tweezers (optional)
- Field Activity Daily Log (FADL)
- Smear Analysis Data Form
- Instrument Instruction Manual
- Metric unit (centimeter) ruler

4.2 Calibration Required

The Ludlum Model 2929/43-10-1, Dual Channel Smear Counter shall be calibrated to a National Institute of Science and Technology (NIST) traceable source at least annually.

5.0 METHOD

5.1 Smear Collection

5.1.1 Obtain swipes from an area of approximately 100 square centimeters (cm^2) when possible (i.e., approximately a square that is 4 inches on each side). When it is not possible to cover this area, make an estimate of the surface area (cm^2) and note on the FADL.

5.1.2 Use sufficient pressure on the swipe to pick up loose contamination without tearing or separating the swipe.

5.1.3 During swipe survey, pay particular attention to areas on equipment where contamination is most likely to occur.

5.2 Analysis of Smear

5.2.1 For a quantitative measurement, analyze the smear by placing it into the smear counter drawer. Tweezers may be used for ease of placement and removal from drawer. (Note: if only a qualitative field measurement is desired to assess clean or contaminated equipment, analyze the smear by placing it under a radiation survey probe such as the Geiger-Muller probe rather than in a smear counter drawer.)

5.2.2 Close and lock the sample drawer by pushing in the drawer and moving the lever up on the right side of the detector.

5.2.3 Set the counting time on the counter for one minute, or as otherwise instructed, by turning the MINUTES switch to 01 and the MULTIPLIER switch to 1.0.

5.2.4 Turn the power ON.

5.2.5 Push the COUNT button to initiate a count cycle. This button will also reset the two counters when depressed.

5.2.6 The counting lamp will be lit during the count cycle.

5.2.7 When the lamp goes out the count cycle is over. Record the counter readings on the Smear Analysis Data Form (Attachment A).

5.2.8 Calculate the net count by the following equation:

$$\text{Net (ncpm)} = \text{Gross (cpm)} - \text{Background (cpm)},$$

Where cpm = counts per minute.

5.2.9 Record on Smear Analysis Data Form. Calculate smear activity in decays per minute (dpm) by the following equation:

$$\text{Activity (dpm/100 cm}^2\text{)} = \text{Net (ncpm)} * \left(\frac{1}{\text{efficiency}}\right)$$

5.2.10 Use the efficiency calculated for the instrument in SOP-CHR-18, Daily Source and Background Checks.

6.0 REQUIRED INSPECTION/ACCEPTANCE CRITERIA

6.1 Instrument must be working properly in accordance with SOP-CHR-18.

6.2 Smear analysis activities that exceed values established for the Chariot Site, as outlined in SOP-CHR-09, shall be evaluated by the Project Manager.

7.0 RECORDS

The following records generated as a result of implementation of this procedure shall be retained as quality records in accordance with DOE Order 1324.2A, Record Disposition and IT QA Program requirements.

7.1 Smear Analysis Form

7.2 Field Activity Daily Log

8.0 REFERENCES

8.1 Requirements and Specifications

U.S. Department of Energy, Nevada Operations Office, July 1993, "Quality Assurance Project Plan," *Project Chariot: 1962 Tracer Study Site Assessment and Remedial Action Plan*, Appendix A, DOE/NV/93-085, Las Vegas, Nevada.

8.2 Related Procedures

8.2.1 SOP-CHR-09, Shipment of Samples

8.2.2 SOP-CHR-18, Daily Source and Background Checks

8.3 Others

8.3.1 Instruction Manual Ludlum Model 2929 Dual Channel Scaler.

8.3.2 Instruction Manual, Ludlum Model 43-10-1 Alpha-Beta Sample Counter.

9.0 ATTACHMENTS

Attachment A - Smear Analysis Data Form

ATTACHMENT A

SMEAR ANALYSIS DATA FORM
(Page 1 of 1)

SMEAR ANALYSIS DATA FORM

PROJECT CHARIOT ______________________ Date: ____________

FIELD ACTIVITY SUBJECT: ______________________

DESCRIPTION OF SMEAR LOCATIONS: ______________________

Smear #	Gross β/γ (cpm)	Net β/γ (ncpm)	β/γ (dpm/100cm²)	Gross α (cp5m)	Gross α (cpm)	Net α (ncpm)	α (dpm/100cm²)	Comments

Smear Counter Model 2929/43-10-1 Serial No. ____________

Smears were collected by: ______________________

Smears were counted by: ______________________

Comments ______________________

INTERNATIONAL
TECHNOLOGY
CORPORATION

ITLV

STANDARD OPERATING PROCEDURE

NUMBER: CHR-27

TITLE: **Operation of the Geiger-Mueller (Pancake) Detector and Survey Meter**

APPROVED: [signature] **DATE:** 7/9/93
ITLV Program Manager

APPROVED: [signature] **DATE:** 7-9-93
ITLV Project Manager

APPROVED: [signature] **DATE:** 7-9-93
ITLV Quality Assurance Officer

CONTROLLED COPY NO. : _____

Revision No.	**Date**

TABLE OF CONTENTS

1.0 SCOPE AND OBJECTIVE

1.1 Scope - This procedure applies to the operation of the Ludlum® Model 44-9 Geiger-Mueller (G-M) Pancake Probe with the Ludlum® Model 3 Survey Meter at the 1962 Tracer Study Test Plot Area of the Project Chariot Site.

1.2 Objective - The objective of this procedure is to provide a method for surveying suspected areas or objects for alpha, beta, and gamma radiation.

2.0 DEFINITIONS

2.1 Calibration - The check or correction of the accuracy of a measuring instrument to assure proper operational characteristics.

2.2 May - The word may is use to denote permissibility.

2.3 Shall - The word shall denotes a requirement.

2.4 Should - The word should is used when an element is recommended.

3.0 RESPONSIBILITIES AND QUALIFICATIONS

3.1 IT Project Manager - The IT Project Manager is responsible for assuring the implementation of this procedure during the performance of project activities.

3.2 Quality Assurance Officer - The Quality Assurance Officer is responsible for approving this procedure and performing surveillances to verify compliance with this procedure.

3.3 Sampling and Analysis Supervisor - The Sampling and Analysis Supervisor (SAS) is responsible for the implementation of this procedure. The SAS shall select qualified personnel to perform this activity.

3.4 Field Personnel - Field personnel are responsible for meeting the requirements of this procedure and of the Site-Specific Health and Safety Plan (SSHASP).

4.0 MATERIALS/EQUIPMENT AND CALIBRATION REQUIRED

4.1 Materials/Equipment

- Ludlum® Model 44-9 G-M Pancake Probe and associated equipment.
- Ludlum® Model 3 Survey meter and associated equipment
- Cesium-137 (Cs-137) check source
- Field Activity Daily Log (FADL)

4.2 Calibration Required

4.2.1 The instrument being used shall be calibrated prior to use at least annually and have a current calibration certificate.

4.2.2 Any instrument exceeding the state calibration expiration date shall not be used and shall be tagged "out of service."

4.2.3 Operational and source checks shall be performed and recorded, in the FADL, before and after an instrument is used.

5.0 METHOD

5.1 Initial Setup

5.1.1 Connect the Ludlum® Model 44-9 Pancake Probe (Attachment A) to the Ludlum® Model 3 Survey meter (Attachment B) using the high voltage cable provided.

5.1.2 Set the audio switch to the "on" position when in use and to the "off" position when not in use.

5.1.3 Set the detector response switch to the slow (S) position.

5.2 Battery Check

5.2.1 Set the range switch to the battery position.

5.2.2 If the response needle is not in or to the right of the area marked as "BAT TEST" then the battery should be changed.

5.3 Background and Source Checks

5.3.1 Set the range switch to the appropriate multiplier position (X100, X10, X1 or X0.1). See Attachment B.

5.3.2 Use the reset button to force the meter reading to zero.

5.3.3 SOP-CHR-18, Daily Source and Background Checks, shall be followed for performance of the required checks.

5.3.4 Read the scale marked "CPM" for counts per minute (cpm) and multiply by the associated factor on the range selector switch.

5.4 Operation

5.4.1 Set the range switch to the appropriate multiplier position (X100, X10, X1 or X0.1).

5.4.2 Use the reset button to force the meter reading to zero.

5.4.3 Hold the "head" of the pancake probe in the palm of your hand or by the handle.

5.4.4 Survey the suspected area or object less than 1 inch above the surface at a rate of 2 inches per second.

5.4.5 While surveying, if the count rate exceeds 100 cpm above background, then the suspected area or object is determined to be contaminated.

5.4.6 If the suspected area or object is contaminated, it must be disposed of properly or decontaminated following the steps in SOP-CHR-04, Field Decontamination.

6.0 REQUIRED INSPECTION/ACCEPTANCE CRITERIA

Calibration check measurements of radiation survey instruments must be within three standard deviations of the mean. If two consecutive measurements fall outside this limit, the instrument must be taken out of service, marked, tagged and segregated, until it is recalibrated.

7.0 RECORDS

The following records, generated as a result of implementation of this procedure, shall be retained as quality records in accordance with DOE Order 1324.2A, Record Disposition and IT QA Program requirements.

- Field Activity Daily Log

8.0 REFERENCES

8.1 Requirements and Specifications

8.1.1 U.S. Department of Energy, Nevada Operations Office, July 1993, "Quality Assurance Project Plan," *Project Chariot: 1962 Tracer Study Site Assessment and Remedial Action Plan*, Appendix A, DOE/NV/93-085, Las Vegas, Nevada.

8.1.2 Ludlum® Model 44-9 Alpha-Beta-Gamma Detector Instruction Manual, February 1992.

8.1.3 Ludlum® Model 3 Survey Meter Instruction Manual, April 1992.

8.2 Related Procedures

8.2.1 SOP-CHR-04, Field Decontamination

8.2.2 SOP-CHR-18, Daily Source and Background Checks

9.0 ATTACHMENTS

9.1 Attachment A - Ludlum® Model 44-9 Pancake Probe

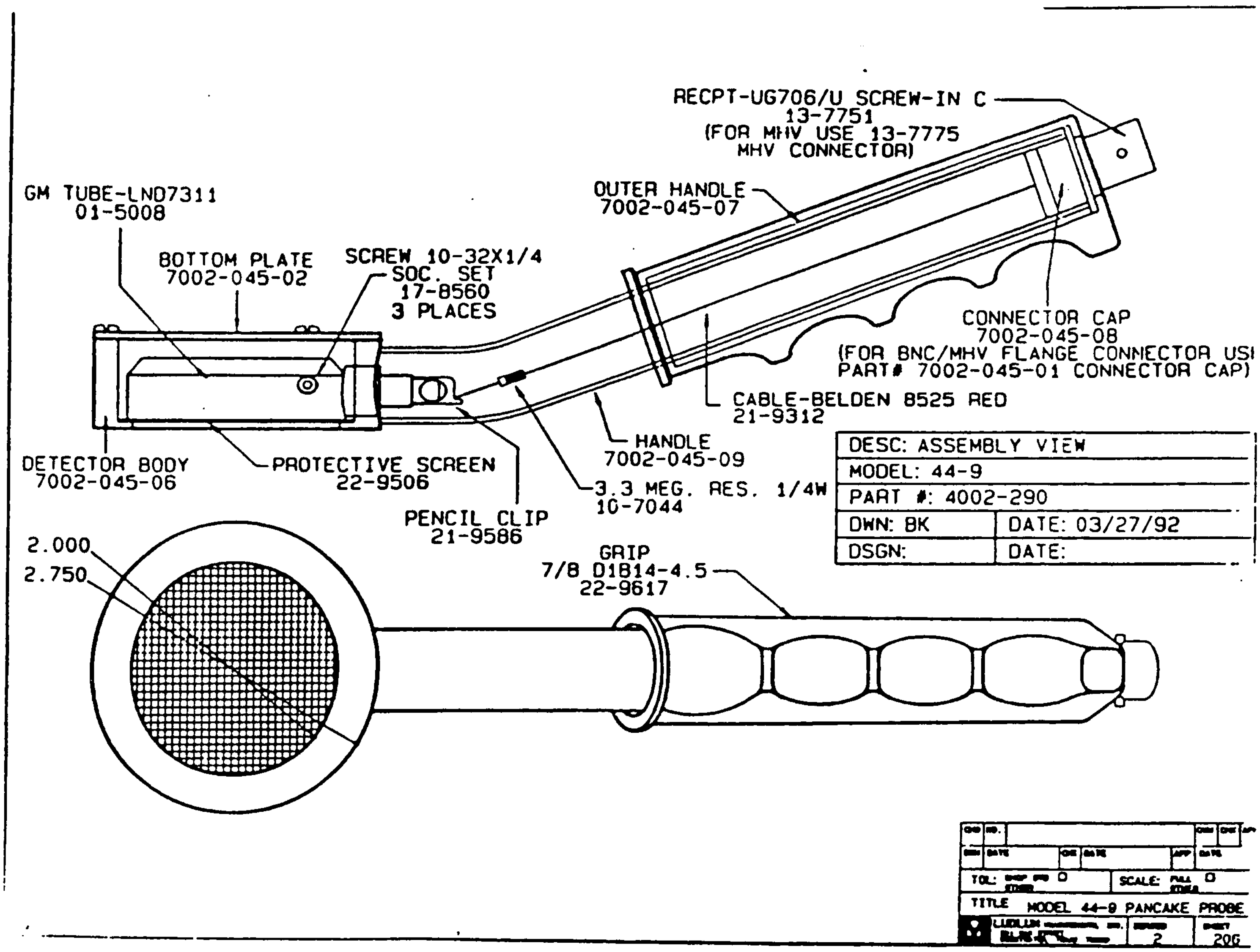
9.2 Attachment B - Ludlum® Model 3 Survey Meter

INTERNATIONAL
TECHNOLOGY
CORPORATION

ATTACHMENT A

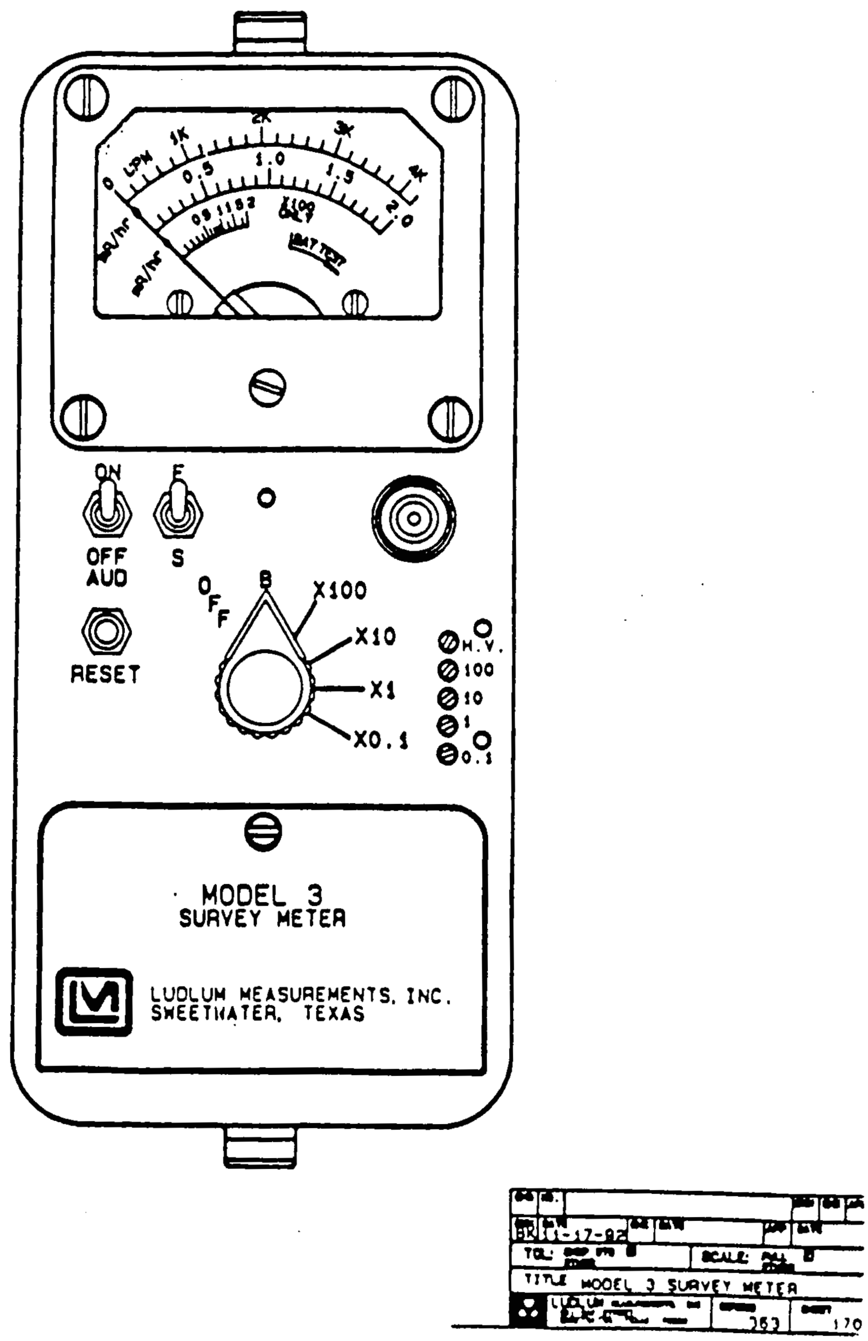
LUDLUM® MODEL 44-9 PANCAKE PROBE

(Page 1 of 1)



ATTACHMENT B

LUDLUM® MODEL 3 SURVEY METER
(Page 1 of 1)



INTERNATIONAL
TECHNOLOGY
CORPORATION

ITLV

STANDARD OPERATING PROCEDURE

NUMBER: CHR-28

TITLE: **Operation of the Alpha Scintillation Probe and Count Rate Meter**

APPROVED: Joseph G. Ekrasted
ITLV Program Manager
DATE: 7/9/93

APPROVED: [signature]
ITLV Project Manager
DATE: 7-9-93

APPROVED: Cheryl D. Prince
ITLV Quality Assurance Officer
DATE: 7-9-93

CONTROLLED COPY NO. : _____

Revision No.	**Date**

TABLE OF CONTENTS

1.0 SCOPE AND OBJECTIVE

1.1 Scope - This procedure applies to the operation of the Ludlum® Model 43-5 Alpha Scintillation Probe with the Ludlum® Model 12 Count Ratemeter at the 1962 Tracer Study Test Plot Area of the Project Chariot Site.

1.2 Objective - The objective of this procedure is to provide a method for surveying suspected areas or object for alpha contamination.

2.0 DEFINITIONS

2.1 Calibration - The check or correction of the accuracy of a measuring instrument to assure proper operational characteristics.

2.2 May - The word may is used to denote permissibility.

2.3 Shall - The word shall denotes a requirement.

2.4 Should - The word should is used when an element is recommended.

3.0 RESPONSIBILITIES AND QUALIFICATIONS

3.1 IT Project Manager - The IT Project Manager is responsible for assuring the implementation of this procedure during the performance of project activities.

3.2 Sampling and Analysis Supervisor - The Sampling and Analysis Supervisor (SAS) shall determine grid requirements and supervise on-site gridding activities to assure compliance with the requirements of this procedure. The SAS is responsible for the assignment of trained personnel to these activities.

3.3 QA Officer - The Quality Assurance Officer is responsible for approving this procedure and performing surveillances to verify compliance with this procedure.

3.4 Field Personnel - Field personnel are responsible for meeting the requirements of this procedure and the Site-Specific Health and Safety Plan (SSHASP).

4.0 MATERIALS/EQUIPMENT AND CALIBRATION REQUIRED

4.1 Material/Equipment

- Ludlum® Model 43-5 Alpha Scintillation Probe and associated equipment
- Ludlum® Model 12 Count Ratemeter and associated equipment
- Thorium-230 check source
- Field Activity Daily Log (FADL)

4.2 Calibration Required

4.2.1 The instrument being used shall be calibrated prior to use at least annually and have a current calibration certificate.

4.2.2 Any instrument exceeding the state calibration expiration date shall not be used and shall be tagged "out-of-service".

4.2.3 Operational and source checks shall be performed and recorded before and after each instrument is used and these checks documented in the FADL.

5.0 METHOD

5.1 Initial Step

5.1.1 Connect the Ludlum® Model 43-5 Alpha Scintillation Probe to the Ludlum® Model 12 Count Ratemeter.

5.1.2 Set the audio switch to the "on" position when in use and to the "off" position when not.

5.1.3 Set the detector response switch to the slow (S) position.

5.2 Battery Check

5.2.1 Set the range switch to the battery position.

5.2.2 If the response needle is not in or to the right of the area marked as "BAT TEST", then the battery should be changed.

5.3 Background and Source Checks

5.3.1 Set the range switch to the appropriate multiplier position (X1000, X100, X10, or X1). See Attachment A.

5.3.2 Use the reset button to force the meter reading to zero.

5.3.3 SOP-CHR-18, Daily Source and Background Checks, shall be followed for performance of the required checks.

5.3.4 Read the scale marked 0-500 for counts per minute (cpm) and multiply by the associated factor on the range selector switch.

5.4 Operation

5.4.1 Set the range switch to the appropriate multiplier position (X1000, X100, C10 or X1).

5.4.2 Use the reset button to force the meter reading to zero.

5.4.3 Survey the suspected area or object less than 1 inch above the surface at a rate of 2 inches per second.

5.4.4 While surveying, if the count rate exceeds 20 cpm above background, then the suspected area or object is determined to be contaminated.

6.0 REQUIRED INSPECTION/ACCEPTANCE CRITERIA

Calibration check measurements of radiation survey instruments must be within three standard deviations of the mean. If two consecutive measurements fall outside this limit the instrument must be taken out of service and tagged "out-of-service" until it is recalibrated.

7.0 RECORDS

The following records generated as a result of implementation of this procedure shall be retained as quality records in accordance with DOE Order 1324.2A, Record Disposition and IT QA Program requirements.

- Field Activity Daily Log

8.0 REFERENCES

8.1 Requirements and Specifications

8.1.1 U.S. Department of Energy, Nevada Operations Office, July 1993, "Quality Assurance Project Plan," *Project Chariot: 1962 Tracer Study Site Assessment and Remedial Action Plan*, Appendix A, DOE/NV/93-085, Las Vegas, Nevada.

8.1.2 Ludlum® Model 43-5 Alpha Scintillation Probe Instruction Manual, January 1990.

8.1.3 Ludlum® Model 12 Count Rate Meter Instruction Manual, October 1990.

8.2 Related Procedures

SOP-CHR-18, Daily Source and Background Checks

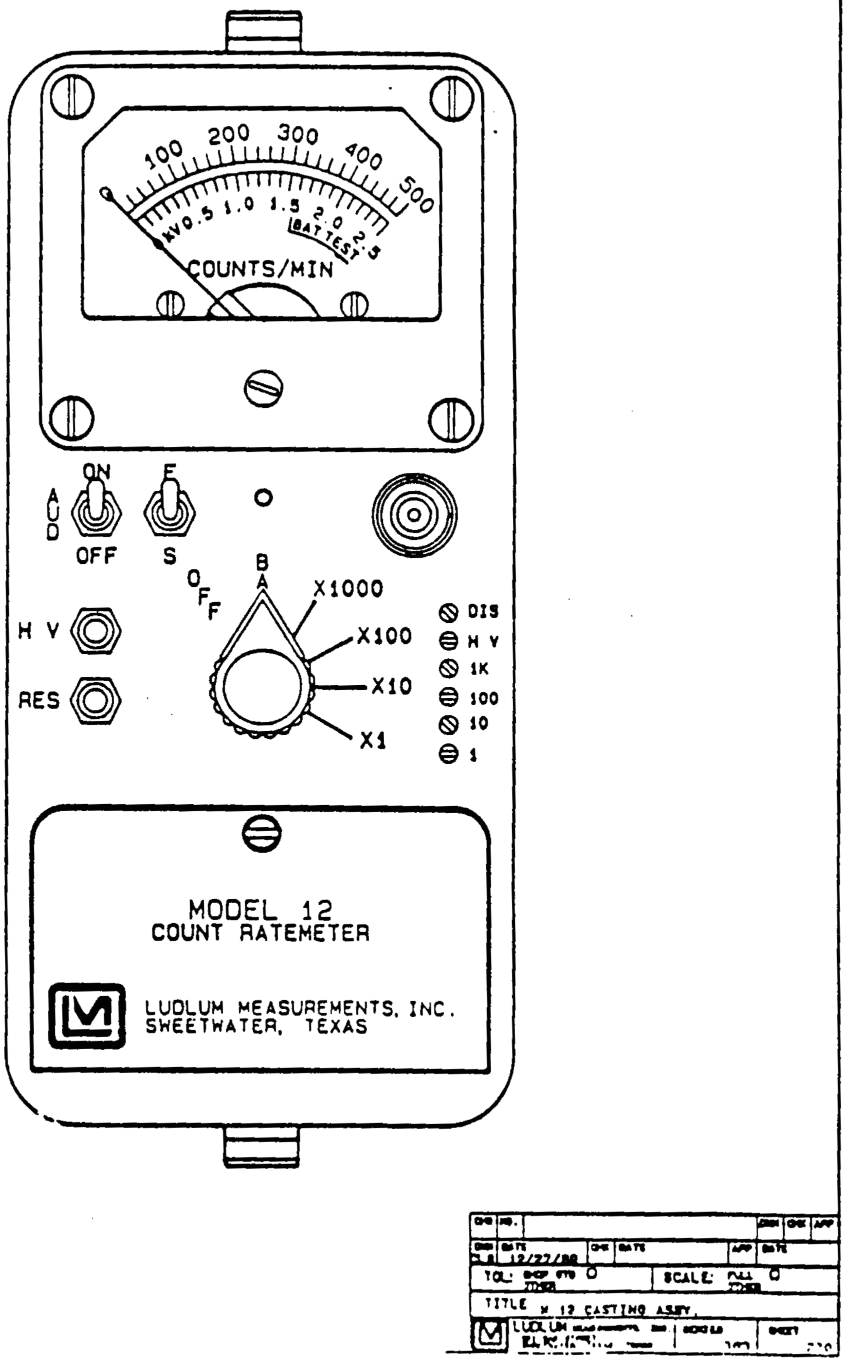
9.0 ATTACHMENTS

Attachment A - Ludlum® Model 12 Count Ratemeter

INTERNATIONAL
TECHNOLOGY
CORPORATION

ATTACHMENT A

LUDLUM® MODEL 12 COUNT RATEMETER
(Page 1 of 1)



This page intentionally left blank

INTERNATIONAL
TECHNOLOGY
CORPORATION

ITLV

STANDARD OPERATING PROCEDURE

NUMBER: CHR-29

TITLE: **Horiba U-10® Water Quality Checker**

APPROVED: Joseph L. Yeasted — ITLV Program Manager **DATE:** 7/9/93

APPROVED: Andrea M. Hopkins — ITLV Project Manager **DATE:** 7-9-93

APPROVED: Cheryl D. Prince — ITLV Quality Assurance Officer **DATE:** 7-9-93

CONTROLLED COPY NO. : _____

Revision No.	Date

TABLE OF CONTENTS

1.0 SCOPE AND OBJECTIVE

1.1 Scope - This SOP provides direction for the calibration and use of the Horiba U-10® Water Quality Checker.

1.2 Objective - The objective of this SOP is to establish standard methodology for the Horiba U-10® Water Quality Checker calibration and field use. This SOP should be consulted during the preparation and execution of any Field Sampling Plan (FSP) that includes use of the Horiba U-10® Water Quality Checker.

2.0 DEFINITIONS

Horiba U-10® Water Quality Checker - An electronic field instrument designed to measure pH, conductivity, turbidity, dissolved oxygen (DO), temperature, and salinity.

3.0 RESPONSIBILITIES AND QUALIFICATIONS

3.1 IT Project Manager - The IT Project Manager is responsible for assuring the implementation of procedure during the performance of project activities.

3.2 Sampling and Analysis Supervisor (SAS) - The SAS is responsible for the implementation of this procedure. The SAS shall select qualified personnel to perform this activity. The SAS shall ensure that personnel executing the protocols described in this SOP shall be instructed in the use of the Horiba U-10® Water Quality Checker and have reviewed the manufacturer's instructions and recommendations.

3.3 Quality Assurance Officer - The Quality Assurance Officer is responsible for the development and maintenance of this procedure.

3.4 Field Personnel - Field personnel are responsible for meeting the requirements of this procedure and for meeting requirements of the Site-Specific Health and Safety Plan (SSHASP).

4.0 MATERIALS/EQUIPMENT AND CALIBRATION REQUIRED

4.1 Materials/Equipment

- Horiba U-10® Water Quality Checker
- Calibration cup
- Horiba standard phthalate pH solution
- Buffer standards of pH 4.0, 7.0, and 10.0
- Granular Potassium Chloride (KCl)
- Hydrazine sulfate
- Hexamethylenetetramine
- Sodium sulfite
- Deionized and/or distilled water
- Analytical balance
- Certified thermometer
- Air pump and tubing
- Plastic bags
- Field Activity Daily Logs (FADLs)
- Manufacturer's Instruction Manual
- Allen wrench
- Barometer.

4.2 Calibration Required

See Sections 5.2 to 5.16.

5.0 METHODS

5.1 Set-up

5.1.1 To set up the Horiba U-10® Water Quality Checker, first loosen the setscrew on the back of the control unit. Remove the back plate and insert a 9-volt battery, carefully noting that the plus and minus poles of the batteries match the terminals correctly. Replace the back plate and tighten the setscrew. If the readout shows Er 1, it means the battery is defective or exhausted and should be replaced.

5.1.2 The dissolved-oxygen (DO) sensor has a delicate membrane that can easily be ruptured. For safety reasons, the U-10 shall be shipped with the DO sensor packed separately. The DO sensor should be inserted just prior to calibration and during use.

5.1.3 Fit the DO sensor lightly into its socket, and tighten securely to the probe using the DO sensor wrench, being careful not to cross thread the screws.

5.1.4 Remove the pH sensor cap.

5.1.5 Remove the tape covering the reference sensor.

5.1.6 Place the probe guard over the sensors, noting the notches for proper alignment.

5.1.7 To disassemble the Horiba U-10® Water Quality Checker, reverse these procedures. Note: Be sure the pH sensor is moist when replacing the cap.

5.1.8 The U-10 Water Quality Checker may be calibrated either manually or automatically. The four-parameter auto-calibration procedure should be sufficient for most measurement operations.

5.1.9 Manual calibration for each of the four parameters is more accurate but also more time consuming. This method should be used for difficult measurements or where more than normal precision is required.

5.1.10 Care should be taken to avoid physical shock, extreme heat, or extreme cold. Any of these conditions may cause the system to be temporarily impaired (stability, calibration), or in extreme conditions damage may be permanently afflicted to the unit.

5.2 Auto-Calibration Procedures

5.2.1 The first three equipment entries listed in Section 4.0 shall always be used to auto-calibrate the Horiba U-10® Water Quality Checker.

5.2.2 Fill the calibration cup about 2/3 with the Horiba standard phthalate pH solution. Note the line on the beaker.

5.2.3 Fit the probe over the calibration cup. Note that the calibration cup is specially shaped to prevent the DO sensor from being immersed in the standard solution. The DO auto-calibration is done using atmospheric air.

5.2.4 With the power on, press the MODE key to put the unit into MAINT mode. The lower cursor should be on the AUTO Sub-Mode; if it is not, use the MODE key to move the lower cursor to AUTO.

5.2.5 With the lower cursor on AUTO, press the ENT key. The readout will show CAL. Wait a moment, and the upper cursor will gradually move across the four auto-calibration parameters one-by-one: pH, COND, TURB, and DO. When the calibration is complete, the readout will briefly show END and then will switch to the MEAS mode.

5.2.6 The upper cursor will blink while the auto-calibration is being made. When the auto-calibration has stabilized, the upper cursor will stop blinking.

5.2.7 After the DO auto-calibration, if the display does not switch to the MEAS mode and the readout shows Er 3 or Er 4, an auto-calibration error has occurred. Parameters will blink where an error has occurred.

5.2.8 If this happens, re-do the auto-calibration. Press the CLR key to cancel the error code. Next, press the ENT key to restart the auto-calibration. Restart the auto-calibration beginning again with pH.

5.3 Manual (Two-Point) Calibration Procedures

5.3.1 As stated previously, a manual, parameter-by-parameter, two-point calibration may be done for high-accuracy measurements. Manual two-point calibration is required if a new probe is being used for the first time.

5.3.2 All the equipment listed in Section 4.0, with the exception of the Horiba standard phthalate solution, is required.

5.4 pH Calibration

5.4.1 Except in certain special situations, pH buffer solutions are the universal standards for pH calibration. There are buffers available with values over virtually the whole pH range. For the most part, Project Chariot will use (at 25°C) the pH values 4.0, 7.0, and 10.0. Supplied in powder form, buffers should be prepared with deionized water according to the instructions provided. Buffer solutions will keep for a few weeks at room temperature and can be made up and stored for calibration purposes. For best results, use prepared liquid pH buffers, as the manufacturer will provide pH values of standard solutions at various temperatures on the bottle.

5.4.2 For best precision, calibrate for the range of pH values expected in the field. That is, for high pH waters, calibrate at 7.0 and 10.0. For acid waters, calibrate at 7.0 and 4.0.

5.5 pH Zero Calibration

5.5.1 Double and triple rinse the probe using deionized or distilled water. Place it in the calibration cup with pH 7 standard solution.

5.5.2 With the power on, press the MODE key to put the unit into MAINT mode.

5.5.3 Press the MODE key again to move the lower cursor to ZERO.

5.5.4 Use the SELECT key to move the upper cursor to pH.

5.5.5 When the readout has stabilized, use the UP/DOWN keys to select the value of the pH 7 standard solution at the temperature of the sample. Refer to the manufacturer's tables for pH values of standard solutions at various temperatures.

5.5.6 Press the ENT key to complete the zero calibration for pH.

5.6 pH Span Calibration

5.6.1 Double and triple rinse the probe in deionized or distilled water. Place the probe in the calibration cup with pH 4 or pH 10 standard solution.

5.6.2 Use the MODE key to move the lower cursor to SPAN.

5.6.3 When the readout has stabilized, use the UP/DOWN keys to select the value of the standard solution (i.e., either pH 4 or pH 10) at the temperature of the sample. Refer to the manufacturer's tables for pH values of standard solutions at various temperatures.

5.6.4 Press the ENT key to complete the span calibration for pH.

5.7 Conductivity Calibration

The U-10 can measure conductivity in the range of 0-100 millisiemens/centimeter (mS/cm). Depending on the sample concentration, however, the U-10 automatically selects the proper range out of its three possible ranges of 0-1 mS/cm, 1-10 mS/cm, and 10-100 mS/cm. Therefore, if manual calibration for conductivity is done, it must be done for all three ranges. Since the zero-point is common for all three ranges, only the three, one-point span calibrations need to be done separately.

Table 1
Making the Potassium Chloride Solutions

KCl Standard Solution	Conductivity* mS/cm	KCl weight g/L	Range to be calibrated mS/cm
0.005 N	0.718	0.373	0 - 1
0.05 N	6.67	3.73	1 - 10
0.5 N	58.7	37.28	10 - 100

*Temperature of solution: 25°C

5.8 <u>Conductivity Zero Calibration</u>

5.8.1 Wash the probe two to three times, using deionized or distilled water. Shake the probe to remove any water droplets from the conductivity sensor. Then allow it to dry exposed to fresh air.

5.8.2 Use the MODE key to move the lower cursor to ZERO.

5.8.3 Use the SELECT key to move the upper cursor to COND.

5.8.4 Use the UP/DOWN keys to set the readout to 0.0.

5.8.5 Press the ENT key. This completes the zero calibration for conductivity.

5.9 <u>Conductivity Span Calibration</u>

5.9.1 Wash the probe two to three times using deionized or distilled water. Following this, wash it two to three times in the first KCl solution prepared. Place the probe in the calibration cup of the KCl solution maintained at a temperature of 25 ± 5°C.

5.9.2 Use the MODE key to move the lower cursor to SPAN.

5.9.3 After the readout stabilizes, use the UP/DOWN keys to set the value of the KCl standard solution, referring to Table 1 in Section 5.7.

5.9.4 Press the ENT key to complete the span calibration for this conductivity range.

5.9.5 Repeat this procedure for the remaining two KCl solutions.

5.10 Turbidity Calibration

5.10.1 To prepare the standard solution for the turbidity span calibration, dissolve 5.0 grams of hydrazine sulfate in 400 milliliters of deionized or distilled water. Next, dissolve 50 grams of hexamethylenetetramine into 400 milliliters of deionized or distilled water. Mix these two solutions, and bring the volume up to 1 liter using deionized or distilled water. Stir this mixture thoroughly and allow to stand 24 hours at 25 ± 3°C.

5.10.2 The turbidity of this stock solution is equivalent to 4,000 nephalometric turbidity units (NTU), and will remain accurate for six months.

5.10.3 To prepare the standard span solution of 800 NTU, measure out 50 milliliters of the 4,000 NTU stock solution, and bring the volume up to 250 milliliters using deionized or distilled water.

5.10.4 This solution will precipitate easily. Therefore, be sure to stir the solution thoroughly before use.

5.11 Turbidity Zero Calibration

5.11.1 Wash the probe two to three times, using deionized or distilled water. Shake off the excess water droplets and place it into the calibration cup with deionized or distilled water.

5.11.2 Use the MODE key to move the lower cursor to ZERO.

5.11.3 Use the SELECT key to move the upper cursor to TURB.

5.11.4 After the readout has stabilized, set it to 0.0 using the UP/DOWN keys.

5.11.5 Press the ENT key to complete the zero calibration for turbidity.

5.12 Turbidity Span Calibration

5.12.1 Wash the probe thoroughly, using deionized or distilled water. Shake off the excess water droplets. Stir the 800 NTU standard solution and put it into the calibration cup with the probe.

5.12.2 Use the MODE key to move the lower cursor to SPAN.

5.12.3 After the readout has stabilized, i.e., about 60 to 90 seconds, set the readout to 800 NTU with the UP/DOWN keys.

5.12.4 Press the ENT key to complete the span calibration for turbidity.

5.13 Dissolved Oxygen Calibration

5.13.1 A zero standard solution is used for the DO zero calibration. Add about 50 grams of sodium sulfite to 1 liter of either deionized or tap water. Stir this until the reagent is completely dissolved.

5.13.2 An oxygen-saturated span solution is used for the DO span calibration. Put 1 or 2 liters of deionized or tap water in a container. Use an air pump to bubble air through the solution until it is oxygen saturated.

5.14 Dissolved Oxygen Zero Calibration

5.14.1 Wash the probe two to three times in deionized or tap water, and place it in the zero standard solution making sure the DO sensor is immersed.

5.14.2 Use the MODE key to move the lower cursor to ZERO.

5.14.3 Use the SELECT key to move the upper cursor to DO.

5.14.4 After the readout has stabilized, set it to 0.0 using the UP/DOWN keys.

5.14.5 Press the ENT key. This completes the zero calibration for DO.

5.15 Dissolved Oxygen Span Calibration

5.15.1 Wash the probe two to three times in deionized or tap water, and put it in the span standard solution making sure the DO sensor is immersed.

5.15.2 First be sure the U-10 is set for fresh water readings. To do this, set the S.SET Sub-Mode to 0.0% (see Section 5.17).

5.15.3 Use the MODE key to move the lower cursor to SPAN. Use the SELECT key to move the upper cursor to DO.

5.15.4 After the readout has stabilized, while slowly moving the probe up and down in the span standard solution, set the readout value to the appropriate DO value, using the UP/DOWN keys, for the temperature of this solution. For DO values at various temperatures, refer to Table 2.

5.15.5 Press the ENT key to complete the span calibration for DO.

5.16 Dissolved Oxygen Air Calibration

Almost any gas mixture or liquid having a stable and known oxygen partial pressure could be used for calibrating the DO system. A common standard and the one discussed herein for calibration will be water-saturated air. Aside from a correction that must be made for barometric pressure, the oxygen content of water-saturated air at a given temperature has been much studied and is well known.

The critical items to be careful of during the calibration are, temperature, water-saturation, and barometric pressure.

5.16.1 Fill the calibration cup with de-ionized or tap water, and place the probe into the cup. Using the corner of a paper wiper, carefully blot away any water droplets on the DO sensor.

5.16.2 Set the probe and cup into a plastic bag being careful not to re-wet the DO sensor. Seal the bag at the top loosely. This will ensure the barometric pressure on the inside and outside of the bag are equal, while preventing air currents within the bag.

Table 2
Amounts of Saturated Dissolved Oxygen at Various Temperatures
Salinity 0.0%

Temperature °C	DO in mg/L	Temperature °C	DO in mg/L
0	14.16	21	8.68
1	13.77	22	8.53
2	13.40	23	8.39
3	13.04	24	8.25
4	12.70	25	8.11
5	12.37	26	7.99
6	12.06	27	7.87
7	11.75	28	7.75
8	11.47	29	7.64
9	11.19	30	7.53
10	10.92	31	7.42
11	10.67	32	7.32
12	10.43	33	7.22
13	10.20	34	7.13
14	9.97	35	7.04
15	9.76	36	6.94
16	9.56	37	6.86
17	9.37	38	6.76
18	9.18	39	6.68
19	9.01	40	6.59
20	8.84		

mg/L = milligrams per liter

5.16.3 Wait 5 to 10 minutes while the temperature of the probe, water, and air inside the bag equalize. While waiting, use a barometer, if necessary, to determine the local absolute barometric pressure; that is, what a mercury barometer would read in the laboratory. Weather bureau readings cannot be used directly because they are corrected to sea level (the effect of altitude is removed). Be sure the reading is in units of millimeters of mercury or torr.

5.16.4 After the appropriate time period has passed (temperature changes should be no more than one tenth of a degree in 5 seconds), refer to Attachment B for the DO concentration that corresponds both to the temperature of the water in the calibration cup and to the barometric pressure.

5.16.5 Use the MODE key to move the lower cursor to SPAN.

5.16.6 Use the SELECT key to move the upper cursor to DO.

5.16.7 Use the UP/DOWN keys to adjust the DO value to that from Attachment B.

5.16.8 Press the ENT key to complete the DO air calibration.

5.17 Fresh Water/Salt Water Settings - The U-10 can be set to the salinity for either fresh water or salt water when measuring DO. This is done by using the S.SET Sub-Mode.

5.17.1 Measuring Fresh Water

5.17.1.1 Use the MODE key to put the U-10 in the MAINT mode. Keep pressing the MODE key to toggle the lower cursor to the S.SET Sub-Mode.

5.17.1.2 Once in the S.SET Sub-Mode, use the UP/DOWN keys to select the salinity value of 0.0% for fresh water.

5.17.1.3 Press the ENT key to complete the salinity setting while in the S.SET Sub-Mode.

5.17.1.4 When the salinity setting has been made, switch back to the MEAS mode by pressing the MODE key.

5.17.2 Measuring Salt Water

5.17.2.1 Use the MODE key to put the U-10 in the MAINT mode. Keep pressing the MODE key to toggle the lower cursor to the S.SET Sub-Mode.

5.17.2.2 For salt water, set it to A, i.e., for auto-salinity, using the UP/DOWN keys.

5.17.2.3 The A setting should be sufficient for measurements of normal sea water with a salinity value close to 3.3%. For sea water of an unusual salinity, however, and where the value is otherwise known, the value may be set manually to any salinity within the range of 0.0 percent to 4.0 percent. (A manual setting may also be used if the conductivity sensor is malfunctioning, but it is still desirable to take readings of other parameters).

5.17.2.4 Press the ENT key to complete the salinity setting while in the S.SET Sub-Mode.

5.17.2.5 When the salinity setting has been made, switch back to the MEAS mode by pressing the MODE key.

5.18 <u>How to Make a Measurement</u> - Once calibrations have been completed and saved, the unit may be turned off and on again without losing the calibration settings. Also, the battery may be removed and replaced without losing the calibration settings, provided the unit is turned OFF.

BE CAREFUL!!! Never drop or throw the probe into the water. It is a precision instrument containing five delicate sensors and five pre-amps; damage beyond repair may occur by unnecessary rough handling.

5.18.1 When the power is first turned on, the U-10 will be in MEAS mode with all the LCD segments activated. After about 2 seconds, the readout will change to show that a new measurement is being made. The readout will show the last parameter that the upper cursor was on when the previous measurement was made.

5.18.2 All six parameters are automatically measured at once. Use the SELECT key to toggle the upper cursor to the parameter to be measured. To get a uniform reading, slowly move the probe up and down to circulate water through it. (Move it 1 foot [30 cm] per second.) Then wait for the readout to stabilize while doing this.

5.18.3 Use the EXP readout mode to see results with one additional decimal place of accuracy. The EXP key toggles the readout back and forth between standard and expanded display.

6.0 REQUIRED INSPECTION/ACCEPTANCE CRITERIA

None

7.0 RECORDS

All calibration recordings and quantitative field parameters shall be recorded and maintained on Field Activity Daily Logs (FADLs) (refer to SOP-CHR-01, Sample Control and Documentation). FADLs shall be retained as quality records in accordance with DOE Order 1324.2A, Record Disposition, and IT QA Program requirements.

8.0 REFERENCES

8.1 Requirements and Specifications

Horiba Instruments, Inc. "Instruction Manual for U-10® Water Quality Checker." Rev. 1991.

8.2 Related Procedures

SOP-CHR-01, Sample Control and Documentation

8.3 Others

None

9.0 ATTACHMENTS

Attachment A - Air Calibration Oxygen Values

ATTACHMENT A

AIR CALIBRATION OXYGEN VALUES
(Page 1 of 4)

		Oxygen Solubility at Indicated Pressure (mmHg)						
T, Deg C	P(H2O)	760	755	750	745	740	735	730
0	4.58	14.57	14.47	14.38	14.28	14.18	14.09	13.99
1	4.93	14.17	14.08	13.98	13.89	13.79	13.70	13.61
2	5.29	13.79	13.70	13.61	13.52	13.42	13.33	13.24
3	5.68	13.43	13.34	13.25	13.16	13.07	12.98	12.90
4	6.10	13.08	12.99	12.91	12.82	12.73	12.65	12.56
5	6.54	12.74	12.66	12.57	12.49	12.40	12.32	12.23
6	7.01	12.42	12.34	12.26	12.17	12.09	12.01	11.93
7	7.51	12.11	12.03	11.95	11.87	11.79	11.71	11.63
8	8.04	11.81	11.73	11.65	11.57	11.50	11.42	11.34
9	8.61	11.53	11.45	11.38	11.30	11.22	11.15	11.07
10	9.21	11.26	11.19	11.11	11.04	10.96	10.89	10.81
11	9.84	10.99	10.92	10.84	10.77	10.70	10.62	10.55
12	10.52	10.74	10.67	10.60	10.53	10.45	10.38	10.31
13	11.23	10.50	10.43	10.36	10.29	10.22	10.15	10.08
14	11.99	10.27	10.20	10.13	10.06	10.00	9.93	9.86
15	12.79	10.05	9.98	9.92	9.85	9.78	9.71	9.65
16	13.63	9.83	9.76	9.70	9.63	9.57	9.50	9.43
17	14.53	9.63	9.57	9.50	9.44	9.37	9.31	9.24
18	15.48	9.43	9.37	9.30	9.24	9.18	9.11	9.05
19	16.48	9.24	9.18	9.12	9.05	8.99	8.93	8.87
20	17.54	9.06	9.00	8.94	8.88	8.82	8.75	8.69
21	18.65	8.88	8.82	8.76	8.70	8.64	8.58	8.52
22	19.83	8.71	8.65	8.59	8.53	8.47	8.42	8.36
23	21.07	8.55	8.49	8.43	8.38	8.32	8.26	8.20
24	22.38	8.39	8.33	8.28	8.22	8.16	8.11	8.05
25	23.76	8.24	8.18	8.13	8.07	8.02	7.96	7.90
26	25.21	8.09	8.03	7.98	7.92	7.87	7.81	7.76
27	26.74	7.95	7.90	7.84	7.79	7.73	7.68	7.62
28	28.35	7.81	7.76	7.70	7.65	7.60	7.54	7.49
29	30.04	7.68	7.63	7.57	7.52	7.47	7.42	7.36
30	31.82	7.55	7.50	7.45	7.39	7.34	7.29	7.24
31	33.70	7.42	7.37	7.32	7.27	7.22	7.16	7.11
32	35.66	7.30	7.25	7.20	7.15	7.10	7.05	7.00
33	37.73	7.18	7.13	7.08	7.03	6.98	6.93	6.88
34	39.90	7.07	7.02	6.97	6.92	6.87	6.82	6.78
35	42.18	6.95	6.90	6.85	6.80	6.76	6.71	6.66
36	44.56	6.84	6.79	6.74	6.70	6.65	6.60	6.55
37	47.07	6.73	6.68	6.64	6.59	6.54	6.49	6.45
38	49.69	6.63	6.58	6.54	6.49	6.44	6.40	6.35
39	52.44	6.52	6.47	6.43	6.38	6.34	6.29	6.24
40	55.32	6.42	6.37	6.33	6.28	6.24	6.19	6.15
41	58.34	6.32	6.27	6.23	6.18	6.14	6.09	6.05
42	61.50	6.22	6.18	6.13	6.09	6.04	6.00	5.95
43	64.80	6.13	6.09	6.04	6.00	5.95	5.91	5.87
44	68.26	6.03	5.99	5.94	5.90	5.86	5.81	5.77
45	71.88	5.94	5.90	5.85	5.81	5.77	5.72	5.68

ATTACHMENT A

AIR CALIBRATION OXYGEN VALUES
(Page 2 of 4)

Oxygen Solubility at Indicated Pressure (mmHg)

T. Deg C	725	720	715	710	705	700	695	690
0	13.89	13.80	13.70	13.61	13.51	13.41	13.32	13.22
1	13.51	13.42	13.33	13.23	13.14	13.04	12.95	12.86
2	13.15	13.06	12.97	12.88	12.79	12.69	12.60	12.51
3	12.81	12.72	12.63	12.54	12.45	12.36	12.27	12.18
4	12.47	12.39	12.30	12.21	12.13	12.04	11.95	11.87
5	12.15	12.06	11.98	11.89	11.81	11.73	11.64	11.56
6	11.84	11.76	11.68	11.60	11.51	11.43	11.35	11.27
7	11.55	11.47	11.39	11.31	11.22	11.14	11.06	10.98
8	11.26	11.18	11.10	11.02	10.95	10.87	10.79	10.71
9	10.99	10.92	10.84	10.76	10.69	10.61	10.53	10.46
10	10.74	10.66	10.59	10.51	10.44	10.36	10.29	10.21
11	10.48	10.40	10.33	10.26	10.18	10.11	10.04	9.96
12	10.24	10.17	10.10	10.02	9.95	9.88	9.81	9.74
13	10.01	9.94	9.87	9.80	9.73	9.66	9.59	9.52
14	9.79	9.72	9.65	9.58	9.51	9.45	9.38	9.31
15	9.58	9.51	9.44	9.38	9.31	9.24	9.18	9.11
16	9.37	9.30	9.24	9.17	9.11	9.04	8.97	8.91
17	9.18	9.11	9.05	8.98	8.92	8.85	8.79	8.73
18	8.99	8.92	8.86	8.80	8.73	8.67	8.61	8.54
19	8.81	8.74	8.68	8.62	8.56	8.49	8.43	8.37
20	8.63	8.57	8.51	8.45	8.39	8.33	8.27	8.21
21	8.46	8.40	8.34	8.28	8.22	8.16	8.10	8.04
22	8.30	8.24	8.18	8.12	8.06	8.00	7.95	7.89
23	8.15	8.09	8.03	7.97	7.91	7.86	7.80	7.74
24	7.99	7.94	7.88	7.82	7.76	7.71	7.65	7.59
25	7.85	7.79	7.74	7.68	7.62	7.57	7.51	7.46
26	7.70	7.65	7.59	7.54	7.48	7.43	7.37	7.32
27	7.57	7.52	7.46	7.41	7.35	7.30	7.25	7.19
28	7.44	7.38	7.33	7.28	7.22	7.17	7.12	7.06
29	7.31	7.26	7.21	7.15	7.10	7.05	7.00	6.94
30	7.19	7.14	7.08	7.03	6.98	6.93	6.88	6.82
31	7.06	7.01	6.96	6.91	6.86	6.81	6.76	6.70
32	6.95	6.90	6.85	6.80	6.75	6.70	6.64	6.59
33	6.83	6.78	6.73	6.68	6.63	6.58	6.53	6.48
34	6.73	6.68	6.63	6.58	6.53	6.48	6.43	6.38
35	6.61	6.56	6.51	6.47	6.42	6.37	6.32	6.27
36	6.51	6.46	6.41	6.36	6.31	6.27	6.22	6.17
37	6.40	6.35	6.31	6.26	6.21	6.16	6.12	6.07
38	6.30	6.26	6.21	6.16	6.12	6.07	6.02	5.98
39	6.20	6.15	6.11	6.06	6.01	5.97	5.92	5.87
40	6.10	6.06	6.01	5.96	5.92	5.87	5.83	5.78
41	6.00	5.96	5.91	5.87	5.82	5.78	5.73	5.69
42	5.91	5.86	5.82	5.77	5.73	5.69	5.64	5.60
43	5.82	5.78	5.73	5.69	5.65	5.60	5.56	5.31
44	5.72	5.68	5.64	5.59	5.55	5.51	5.46	5.42
45	5.64	5.59	5.55	5.51	5.47	5.42	5.38	5.34

INTERNATIONAL
TECHNOLOGY
CORPORATION

ATTACHMENT A

AIR CALIBRATION OXYGEN VALUES
(Page 3 of 4)

Oxygen Solubility at Indicated Pressure (mmHg)

T. Deg C	685	680	675	670	665	660	655	650
0	13.12	13.03	12.93	12.83	12.74	12.64	12.54	12.45
1	12.76	12.67	12.57	12.48	12.39	12.29	12.20	12.11
2	12.42	12.33	12.24	12.15	12.05	11.96	11.87	11.78
3	12.09	12.01	11.92	11.83	11.74	11.65	11.56	11.47
4	11.78	11.69	11.61	11.52	11.43	11.35	11.26	11.17
5	11.47	11.39	11.30	11.22	11.13	11.05	10.96	10.88
6	11.18	11.10	11.02	10.94	10.85	10.77	10.69	10.61
7	10.90	10.82	10.74	10.66	10.58	10.50	10.42	10.34
8	10.63	10.55	10.48	10.40	10.32	10.24	10.16	10.08
9	10.38	10.30	10.23	10.15	10.07	10.00	9.92	9.84
10	10.14	10.06	9.99	9.91	9.84	9.76	9.69	9.61
11	9.89	9.82	9.74	9.67	9.60	9.52	9.45	9.38
12	9.67	9.59	9.52	9.45	9.38	9.31	9.24	9.16
13	9.45	9.38	9.31	9.24	9.17	9.10	9.03	8.96
14	9.24	9.17	9.10	9.03	8.97	8.90	8.83	8.76
15	9.04	8.97	8.91	8.84	8.77	8.70	8.64	8.57
16	8.84	8.78	8.71	8.64	8.58	8.51	8.45	8.38
17	8.66	8.60	8.53	8.47	8.40	8.34	8.27	8.21
18	8.48	8.42	8.35	8.29	8.23	8.16	8.10	8.04
19	8.31	8.25	8.18	8.12	8.06	8.00	7.94	7.87
20	8.14	8.08	8.02	7.96	7.90	7.84	7.78	7.72
21	7.98	7.92	7.86	7.80	7.74	7.68	7.62	7.56
22	7.83	7.77	7.71	7.65	7.59	7.53	7.47	7.42
23	7.68	7.62	7.57	7.51	7.45	7.39	7.34	7.28
24	7.54	7.48	7.42	7.37	7.31	7.25	7.20	7.14
25	7.40	7.34	7.29	7.23	7.18	7.12	7.06	7.01
26	7.26	7.21	7.15	7.10	7.04	6.99	6.93	6.88
27	7.14	7.08	7.03	6.97	6.92	6.87	6.81	6.76
28	7.01	6.96	6.90	6.85	6.80	6.74	6.69	6.64
29	6.89	6.84	6.79	6.73	6.68	6.63	6.58	6.52
30	6.77	6.72	6.67	6.62	6.57	6.51	6.46	6.41
31	6.65	6.60	6.55	6.50	6.45	6.40	6.35	6.30
32	6.54	6.49	6.44	6.39	6.34	6.29	6.24	6.19
33	6.43	6.38	6.34	6.29	6.24	6.19	6.14	6.09
34	6.33	0.28	6.24	6.19	6.14	6.09	6.04	5.99
35	6.22	6.18	6.13	6.08	6.03	5.98	5.93	5.88
36	6.12	6.08	6.03	5.98	5.93	5.88	5.84	5.79
37	6.02	5.97	5.93	5.88	5.83	5.79	5.74	5.69
38	5.93	5.88	5.84	5.79	5.74	5.70	5.65	5.60
39	5.83	5.78	8.74	5.69	5.64	5.60	5.55	5.51
40	5.74	5.69	5.65	5.60	5.55	5.51	5.46	5.42
41	5.64	5.60	5.55	5.51	5.46	5.42	5.37	5.33
42	5.55	5.51	5.46	5.42	5.37	5.33	5.28	5.24
43	5.47	5.42	5.38	5.34	5.29	5.25	5.20	5.16
44	5.38	5.33	5.29	5.25	5.20	5.16	5.11	5.07
45	5.29	5.25	5.21	5.16	5.12	5.08	5.03	4.99

ATTACHMENT A

AIR CALIBRATION OXYGEN VALUES
(Page 4 of 4)

Oxygen Solubility at Indicated Pressure (mmHg)

T. Deg C	645	640	635	630	625	620	615	610
0	12.35	12.26	12.16	12.06	11.97	11.87	11.77	11.68
1	12.01	11.92	11.82	11.73	11.64	11.54	11.45	11.36
2	11.69	11.60	11.51	11.41	11.32	11.23	11.14	11.05
3	11.38	11.29	11.20	11.12	11.03	10.94	10.85	10.76
4	11.08	11.00	10.91	10.82	10.74	10.65	10.56	10.48
5	10.80	10.71	10.63	10.54	10.46	10.37	10.29	10.20
6	10.52	10.44	10.36	10.28	10.19	10.11	10.03	9.95
7	10.26	10.18	10.10	10.02	9.94	9.86	9.78	9.70
8	10.00	9.93	9.85	9.77	9.69	9.61	9.53	9.45
9	9.77	9.69	9.61	9.54	9.46	9.38	9.30	9.23
10	9.54	9.46	9.39	9.31	9.24	9.16	9.09	9.01
11	9.31	9.23	9.16	9.09	9.01	8.94	8.87	8.79
12	9.09	9.02	8.95	8.88	8.81	8.73	8.66	8.59
13	8.89	8.82	8.75	8.68	8.61	8.54	8.47	8.40
14	8.69	8.62	8.55	8.49	8.42	8.35	8.28	8.21
15	8.50	8.44	8.37	8.30	8.23	8.17	8.10	8.03
16	8.32	8.25	8.18	8.12	8.05	7.99	7.92	7.85
17	8.14	8.08	8.02	7.95	7.89	7.82	7.76	7.69
18	7.97	7.91	7.85	7.78	7.72	7.66	7.59	7.53
19	7.81	7.75	7.69	7.62	7.56	7.50	7.44	7.38
20	7.66	7.60	7.53	7.47	7.41	7.35	7.29	7.23
21	7.50	7.44	7.38	7.32	7.26	7.20	7.14	7.08
22	7.36	7.30	7.24	7.18	7.12	7.06	7.00	6.94
23	7.22	7.16	7.10	7.05	6.99	6.93	6.87	6.81
24	7.08	7.03	6.97	6.91	6.85	6.80	6.74	6.68
25	6.95	6.90	6.84	6.79	6.73	6.67	6.62	6.56
26	6.82	6.77	6.71	6.66	6.60	6.55	6.49	6.44
27	6.70	6.65	6.59	6.54	6.49	6.43	6.38	6.32
28	6.58	6.53	6.48	6.42	6.37	6.32	6.26	6.21
29	6.47	6.42	6.36	6.31	6.26	6.21	6.15	6.10
30	6.36	6.31	6.25	6.20	6.15	6.10	6.05	5.99
31	6.25	6.19	6.14	6.09	6.04	5.99	5.94	5.89
32	6.14	6.09	6.04	5.99	5.94	5.89	5.84	5.79
33	6.04	5.99	5.94	5.89	5.84	5.79	8.74	5.69
34	5.94	5.89	5.84	5.79	5.74	5.70	5.65	5.60
35	5.84	5.79	5.74	5.69	5.64	5.59	5.55	5.50
36	5.74	5.69	5.64	5.60	5.55	5.50	5.45	5.41
37	5.64	5.60	5.55	5.50	5.46	5.41	5.36	5.31
38	5.56	5.51	5.46	5.42	5.37	5.32	5.28	5.23
39	5.46	5.41	5.37	5.32	5.28	5.23	5.18	5.14
40	5.37	5.33	5.28	5.24	5.19	5.14	5.10	5.05
41	5.28	5.24	5.19	5.15	5.10	5.06	5.01	4.97
42	5.20	5.15	5.11	5.06	5.02	4.97	4.93	4.88
43	5.12	5.07	5.03	4.98	4.94	4.90	4.85	4.81
44	5.03	4.98	4.94	4.90	4.85	4.81	4.77	4.72
45	4.95	4.90	4.86	4.82	4.77	4.73	4.69	4.65

INTERNATIONAL
TECHNOLOGY
CORPORATION

ITLV

STANDARD OPERATING PROCEDURE

NUMBER: CHR-30

TITLE: Splitting Samples

APPROVED: ______________________ **DATE:** 7/9/93
ITLV Program Manager

APPROVED: ______________________ **DATE:** 7-9-93
ITLV Project Manager

APPROVED: ______________________ **DATE:** 7-9-93
ITLV Quality Assurance Officer

CONTROLLED COPY NO. : _____

Revision No.	Date

TABLE OF CONTENTS

1.0 SCOPE AND OBJECTIVE

1.1 Scope - This procedure applies to the splitting of samples for surface water, sediment and surface soil for the purpose of measuring for the presence of radioactivity.

1.2 Objective - The objective of this procedure is to establish a standard method for the collection of split samples that will provide samples representative of the actual site conditions.

2.0 DEFINITIONS

Split Sampling - When interested parties may desire to obtain samples for analysis which are duplicates of those being obtained by IT sampling personnel or contractors.

3.0 RESPONSIBILITIES AND QUALIFICATIONS

3.1 IT Project Manager - The IT Project Manager is responsible for assuring the implementation procedure during the performance of project activities.

3.2 Sampling and Analysis Supervisor (SAS) - The SAS is responsible for implementation of this procedure. The SAS shall select qualified personnel to perform this activity.

3.3 Quality Assurance Officer - The Quality Assurance Officer is responsible for approving this procedure and performing surveillances to verify compliance with this procedure.

3.4 Field Personnel - Field personnel are responsible for meeting the requirements of this procedure and the Site-Specific Health and Safety Plan (SSHASP).

4.0 MATERIALS/EQUIPMENT AND CALIBRATION REQUIRED

For a complete list of required materials and equipment, see Attachment A.

5.0 METHOD

To reduce error introduced by field techniques, samples shall be collected in a consistent manner and use chemically inert sampling devices and containers.

5.1 Preparation

5.1.1 Office

5.1.1.1 Review the SOPs listed in Section 8.0 and the SSHASP.

5.1.1.2 Coordinate schedules/actions with the field staff.

5.1.1.3 Assemble the equipment and supplies listed in Attachment A.

5.1.1.4 Notify the laboratory of planned sample types, the number of samples, and the approximate arrival date.

5.1.1.5 Ensure that the carrier has been contacted regarding the protocol for the transport of the split samples, and ensure that information has been obtained on the regulations and specifications. Shipment of samples shall be performed in accordance with SOP-CHR-02, General Field Instructions and SOP-CHR-09, Shipment of Samples. Chain-of-Custody procedures shall be maintained throughout this effort).

5.1.2 Documentation

5.1.2.1 Obtain and complete a Field Activity Daily Log (FADL). An example is provided in SOP-CHR-01, Sample Control and Documentation.

5.1.2.2 Obtain a sufficient number of the appropriate data collection forms (i.e., Sample Collection Logs, Sample Labels, Chain-of-Custody/

Request for Analysis [COC/RFA] Forms [see CHR-SOP-01, Sample Control and Documentation] and Radiological Survey Forms [see SOP-CHR-04, Field Decontamination]).

5.1.3 Field - All required field preparation for collection of surface water, sediment, and surface soil samples shall be performed as stated in Section 5.1.3 of SOP-CHR-08, Surface Water Sampling; SOP-CHR-07, Sediment Sampling; and SOP-CHR-10, Surface Soil Sampling, respectively.

5.2 Collecting Surface Water Split Samples

5.2.1 All surface water collection methods shall be performed in accordance with Section 5.3 of SOP-CHR-08, Surface Water Sampling.

5.2.2 A sufficient volume of surface water shall be composited in a stainless steel or polypropylene bucket with liner, homogenized, and split evenly into the respective sample containers.

5.2.3 Surface water samples shall be acidified in the field or placed into pre-preserved containers with nitric acid (HNO_3) to a pH of less than 2. Once preserved, each sample container shall be sealed with IT custody tape.

5.3 Collecting Sediment Split Samples

5.3.1 All sediment collection methods shall be performed in accordance with Section 5.3 of SOP-CHR-07, Sediment Sampling.

5.3.2 A sufficient volume of sediment from individual core samples using the top 5 centimeters only shall be collected and composited from each sampling location and placed into a stainless steel bucket or bowl. The total sample volume shall then be homogenized with a stainless steel spoon or mixing device and then distributed evenly to each respective sample container.

5.3.3 Once collected, each sample container shall be sealed with IT custody tape.

5.4 Collecting Surface Soil Split Samples

5.4.1 All surface soil collection methods shall be performed in accordance with Section 5.2 of SOP-CHR-10, Surface Soil Sampling.

5.4.2 A sufficient volume of surface soil shall be collected using a stainless trowel while compositing the sample in a stainless steel bucket or bowl. The total sample volume shall then be homogenized with a stainless steel spoon or mixing device and then distributed evenly to each respective sample container.

5.4.3 Once collected, each sample container shall be sealed with IT custody tape.

5.5 Post Operation

5.5.1 All post-operation activities for surface water split samples shall be performed in accordance with Section 5.4 of SOP-CHR-08, Surface Water Sampling.

5.5.2 All post-operation activities for sediment split sampling shall be performed in accordance with Section 5.4 of SOP-CHR-07, Sediment Sampling.

5.5.3 All post-operation activities for surface soil split sampling shall be performed in accordance with Section 5.3 of SOP-CHR-10, Surface Soil Sampling.

6.0 REQUIRED INSPECTION/ACCEPTANCE CRITERIA

All sample collection containers shall be inspected for integrity, correct material composition, the correct preservative, and correct sample amount required for the analysis to be performed.

7.0 RECORDS

The following records, generated as a result of implementation of this procedure, shall be retained as quality records in accordance with DOE Order 1324.2A, Record Disposition and IT QA Program requirements.

7.1 Field Activity Daily Log

7.2 Sample Collection Log

7.3 Photodocumentation of sampling activities

7.4 Chain-of-Custody/Request for Analysis Form

7.5 Radiological Survey Form

8.0 REFERENCES

8.1 Requirements and Specifications

8.1.1 ASTM C998-83, Standard Method for Sampling Surface Soil for Radionuclides.

8.1.2 U.S. Department of Energy, Nevada Operations Office, July 1993, "Sampling and Analysis Plan," *Project Chariot: 1962 Tracer Study Site Assessment and Remedial Action Plan*, Appendix A, DOE/NV/93-085, Las Vegas, Nevada.

8.2 Related Procedures

8.2.1 SOP-CHR-01, Sample Control and Documentation

8.2.2 SOP-CHR-02, General Field Instructions

8.2.3 SOP-CHR-07, Sediment Sampling

8.2.4 SOP-CHR-08, Surface Water Sampling

8.2.5 SOP-CHR-09, Shipment of Samples

8.2.6 SOP-CHR-10, Surface Soil Sampling

8.3 Others

None

9.0 ATTACHMENTS

Attachment A - Equipment List

ATTACHMENT A

EQUIPMENT LIST
(Page 1 of 1)

- Ziploc® bags (gallon-size)
- Clear packing tape
- Large plastic garbage bags
- Grass clippers
- Camera/film - 35mm
- Compass (Brunton or orienting type)
- 100-foot fiberglass measuring tape
- Pin flags, surveyors tape, stakes
- Stainless-steel mixing bowls (2-liter)
- Stainless-steel knives/spoons/spatulas
- Marker pens, pencils (indelible)
- Sample Collection Logs
- Radiation survey meter
- Hand auger
- Ruler
- Field Activity Daily Logs
- Chain-of-Custody/Request for Analysis Form
- Hand trowels
- 2-milliliter 16 molar HNO_3 ampules
- Radiological Survey Forms
- Replacement nosepieces (2-inch diameter)
- Hand corer extension tube
- Nitrile gloves or equivalent (PVC surgical)
- Sample labels
- Altimeter
- Coolers
- Packing materials
- Custody tape
- Global Positioning System
- USGS 15-minute topographic maps
- Shipping Forms
- Flashlight/extra batteries
- Hammer (5-pound sledge)
- Bound field notebook
- 1,000 milliliter sample containers
- Preservatives (HNO_3, H_2SO_4)
- Plastic bucket (5 gallon)
- Clear plastic disposable beakers
- Deionized or distilled water
- Polypropylene bucket with liner
- Wildco Hand Core Sediment Sampler
- Replacement liner tubes (20-inch length, clear plastic)
- Replacement eggshell catchers (2-inch diameter)
- Core sample removal tool

This page intentionally left blank

APPENDIX B

HEALTH AND SAFETY PLAN

This page intentionally left blank

APPENDIX B

SITE-SPECIFIC HEALTH AND SAFETY PLAN

FOR

Project Chariot: 1962 Tracer Study Site Assessment and Remedial Action

Prepared for:
DOE Nevada Operations Office
Environmental Restoration Division

Prepared by:
IT CORPORATION
Las Vegas, Nevada

July 1993
Revision 0

Site Specific Health and Safety Plan Acknowledgement

I have read, understand, and agree to abide by the provisions as detailed in this Site-Specific Health and Safety Plan prepared by IT Corporation. Failure to comply with these provisions may lead to disciplinary action and/or my dismissal from the work site.

Printed Name	Signature	Organization	Date

Table of Contents

Table of Contents (continued)

1.0 Introduction

1.1 Objectives

The objectives of the remedial action to be performed at Project Chariot are to:

- Remediate the soil disposal mound in accordance with the DOE/NV-prepared and the ADEC-approved Site Assessment and Remedial Action Plan

- Perform the remedial action in a safe, environmentally sound, and cost-effective manner

- Excavate and containerize the tracer study generated soil in the disposal mound, to attain the clean-up level, and to secure the ADEC on-site approval of final closure in an expeditious manner

- Perform a radiological survey of the test plot areas to verify that the tracer study radioisotopes have been removed and to secure the ADEC on-site approval of final closure in an expeditious manner

- Perform surface water and sediment sampling and analysis of Snowbank Creek as part of site assessment activities.

These objectives are tiered from and consistent with the objectives presented in the Site Assessment and Remedial Action Plan. The Site Assessment and Remedial Action Plan establishes the project organization, responsibilities, and authority for the participating organizations.

1.2 Scope

The scope of the remedial action focuses exclusively on the excavation, containerization, and disposal of the soil disposal mound at the Project Chariot site; the performance of a radiological survey of the test plot areas; and the sampling and analysis of surface water and sediment of Snowbank Creek. The soil disposal mound is located approximately 1.2 kilometers (km) (0.75 miles [mi]) north of the original Project Chariot base camp. Based on measurements taken of the mound's dimensions in June 1993, the estimated volume of soil, including up to 1.2 meters (m) (4 feet [ft]) of clean overburden, ranges from 220 cubic meters (m^3) (290 cubic yards [yd^3]) to 500 m^3 (650 yd^3).

A mound dimension of 18 m (57 ft) in width by 17 m (56 ft) in length with a 1.7-m (5.5-ft) height will be used for the soil volume estimate for the entire mound, including "clean" overburden. The north face of the mound has a very gentle slope downward towards the north. The south face of the mound is much steeper and slopes toward the south. Willows were observed all around the mound, except for the peak. The ephemeral pond is located to the south of the mound by several feet. The areas downgradient from the mound was marshy.

The historical photographs taken in 1962 during the tracer study illustrate the phased formation of the soil disposal mound and served as a basis to document assumptions of the volume of soil generated by the tracer study. These assumptions have been confirmed during the DOE-conducted interviews with the individuals who performed the study and who were present during the formation of the soil disposal mound. The tracer-study-generated soil was emptied from 55-gallon drums directly onto the native soil and the wooden boards and polyethylene sheeting were placed with this soil. Based on the review and evaluation of the historical photographs, the area dimensions occupied by this soil is estimated to be approximately 12 m (40 ft) in width, 12 m (40 ft) in length, and up to 0.46 m (1.5 ft) in depth. This dimension of the tracer-study soil pile will result in approximately 45 m^3 (1,600 cubic feet [ft^3]) of tracer-study-generated soil. The in-place soil density at the project site, as published by the U.S. Geological Survey (USGS) *Environment of the Cape Thompson Region, Alaska* (Wilimovsky and Wolfe, 1966) is 1.98 grams per cubic centimeter (g/cm^3) (124.8 pounds per cubic foot [lb/ft^3]). Thus, the estimated weight of the soil to be excavated for disposal is 90 metric tons (100 tons). Using an engineering-estimated bulking factor of 30 percent for the site soil after excavation, the estimated volume of soil to be containerized and disposed is approximately 60 m^3 (2,100 ft^3).

The site assessment and remedial action consists of eight phases:

- Phase I -- Sampling and Analysis of the soil mound for waste disposal classification. The analysis results will be utilized to determine both transportation and disposal requirements.

- Phase II -- Soil Excavation and Containerization. Predecessor activities will include the mobilization of project equipment, materials and personnel to the site; the establishment of the base camp; and the completion of site preparation activities. The soil mound will be excavated utilizing heavy equipment and containerized in Department of Transportation (DOT)-approved B-25 Low Specific Activity (LSA) containers. During the excavation activity, an on-site laboratory equipped with portable radiological instruments will be utilized to field-screen soil samples and to certify decontamination efforts. Upon receipt of ADEC approval of final closure, equipment will be decontaminated and site operations will be demobilized from the site.

- Phase III -- Post-Excavation Sampling and Analysis. Post-excavation soil samples will be collected from the base and sides of the excavation for laboratory analysis to confirm attainment of the established clean-up level. This activity will coincide with the excavation operation. In the event that the laboratory results indicate that additional soil removal is required, the area of concern will undergo supplemental excavation and sampling. Upon achieving the clean-up level and ADEC on-site approval of final closure, the excavated area will be restored to natural grade utilizing on-site soils excavated from the top of the mound.

- Phase IV -- Transportation and Disposal. The containerized soil will be transported in accordance with DOT regulations and disposed of at a federally permitted facility.

- Phase V -- Radiological Survey. A radiological survey of the test plot areas will be performed to verify that the radioisotopes utilized in the tracer study have been removed. In the event that the survey results indicate that the radioisotopes remain above the established clean-up level, the soil within the area will be manually excavated and containerized for disposal. The area will undergo subsequent surveying to verify attainment with the clean-up level.

- Phase VI -- Surface Water and Sediment Sampling. The surface water and sediment of Snowbank Creek will be sampled and analyzed at an off-site laboratory to assess any potential transport of radioisotopes from the tracer study.

- Phase VII -- Biota Sampling. Selected flora and fauna of the Ogotoruk and Kisimilok Valleys will be collected and analyzed for radionuclides by an off-site laboratory. Samples of lichens, sedges, and shrub species will be obtained from several locations in the Ogotoruk valley that were previously studied. Additional sites will be sampled to evaluate the migration of radionuclides from the tracer study mound into soils and vegetation near snowbank creek and at a control site (reference) in Kisimilok valley.

- Phase VIII -- Background. An aerial surface survey and soil sampling will be conducted to establish naturally occurring levels of radionuclides for the undisturbed areas of the Ogotoruk Valley. This will allow for a distinction to be made between "clean" overburden soils and those which may require removal to a licensed facility.

1.3 Site and Location Description

The Project Chariot Site is in the Cape Thompson region, north of the Arctic Circle in northwestern Alaska, between latitudes 66°45'N and 69°00'N (Figure 1-1). This region is bounded on the west by the Chukchi Sea and extends east to longitude 162°00'W. Its physiographic province distribution is 60 percent in the Arctic Foothills Province, 35 percent in the Arctic Mountains Province, and 5 percent in the Western Alaska Province. The principal population centers are Point Hope, Kivalina, Noatak, Kotzebue, and Lisburne.

The Project Chariot Site is at the mouth of the Ogotoruk Creek, latitude 68°06'N and longitude 165°46'W (Figure 1-2). Extreme weather conditions limit access to the site in the winter. The Chukchi Sea is not deep enough to permit the safe operation of deep-draft ships within 1.6 km (1 mi) off-shore near the site.

The Project Chariot Site has three gravel airstrips: a 137-m (450-ft) strip with an azimuth heading of 190°, a 305-m (1,000-ft) strip with a heading of 305°, and a 670-m (2,200-ft) strip with a heading of 335°. The 137-m (450-ft) and 305-m (1,000-ft) landing strips are adjacent to the Chariot camp on the west bank of Ogotoruk Creek. The 670-m (2,200-ft) strip, at which larger aircraft can land and take off, is east of Ogotoruk Creek and about 900 m (3,000 ft) from camp. This runway is rutted and requires grading before it can be used safely.

1.4 Policy Statement

Department of Energy (DOE) policy mandates a safe and healthful work environment for all workers. DOE considers no phase of operations or administration to be of greater importance than injury and illness prevention. Safety takes precedence over expediency or shortcuts.

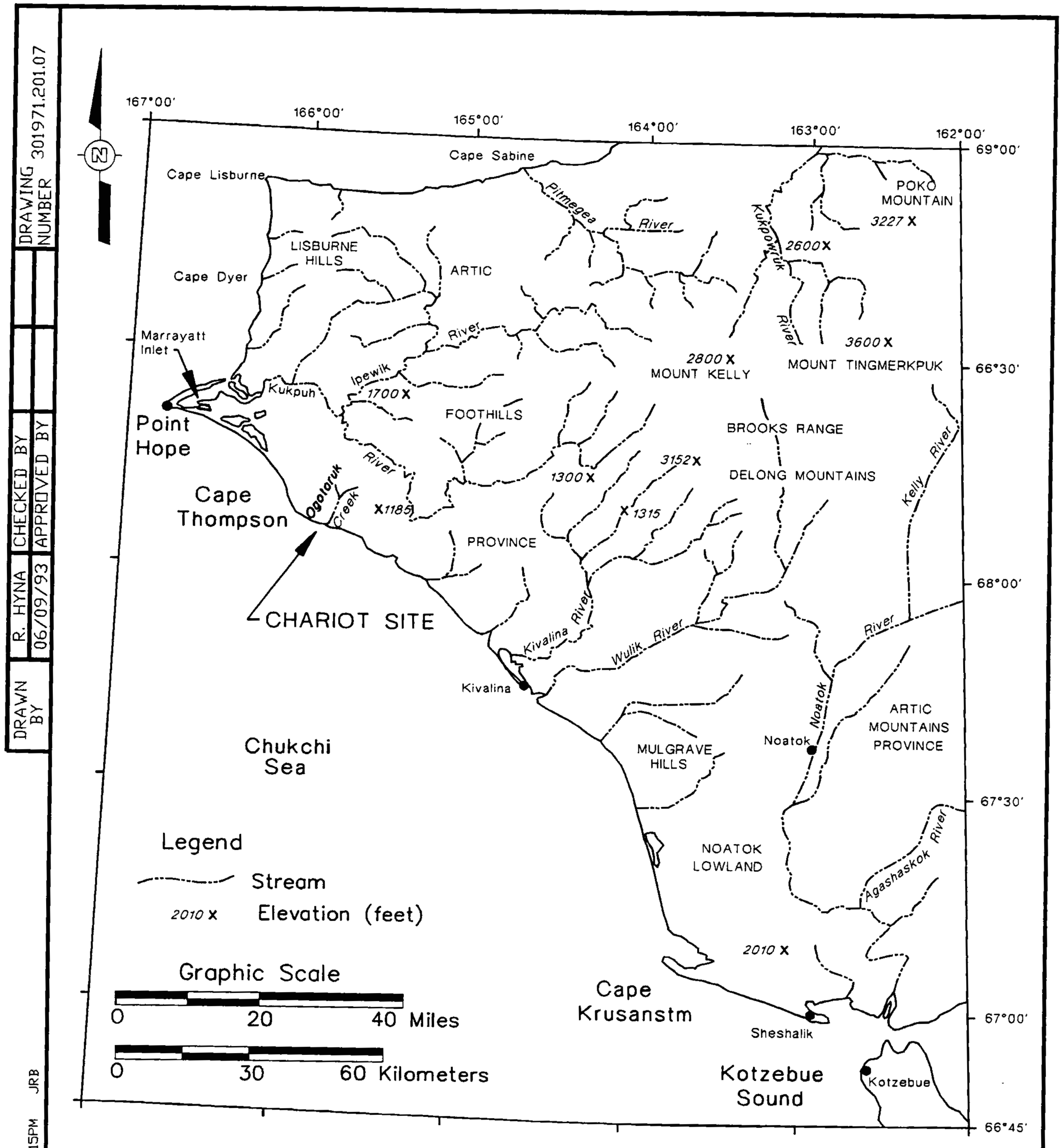
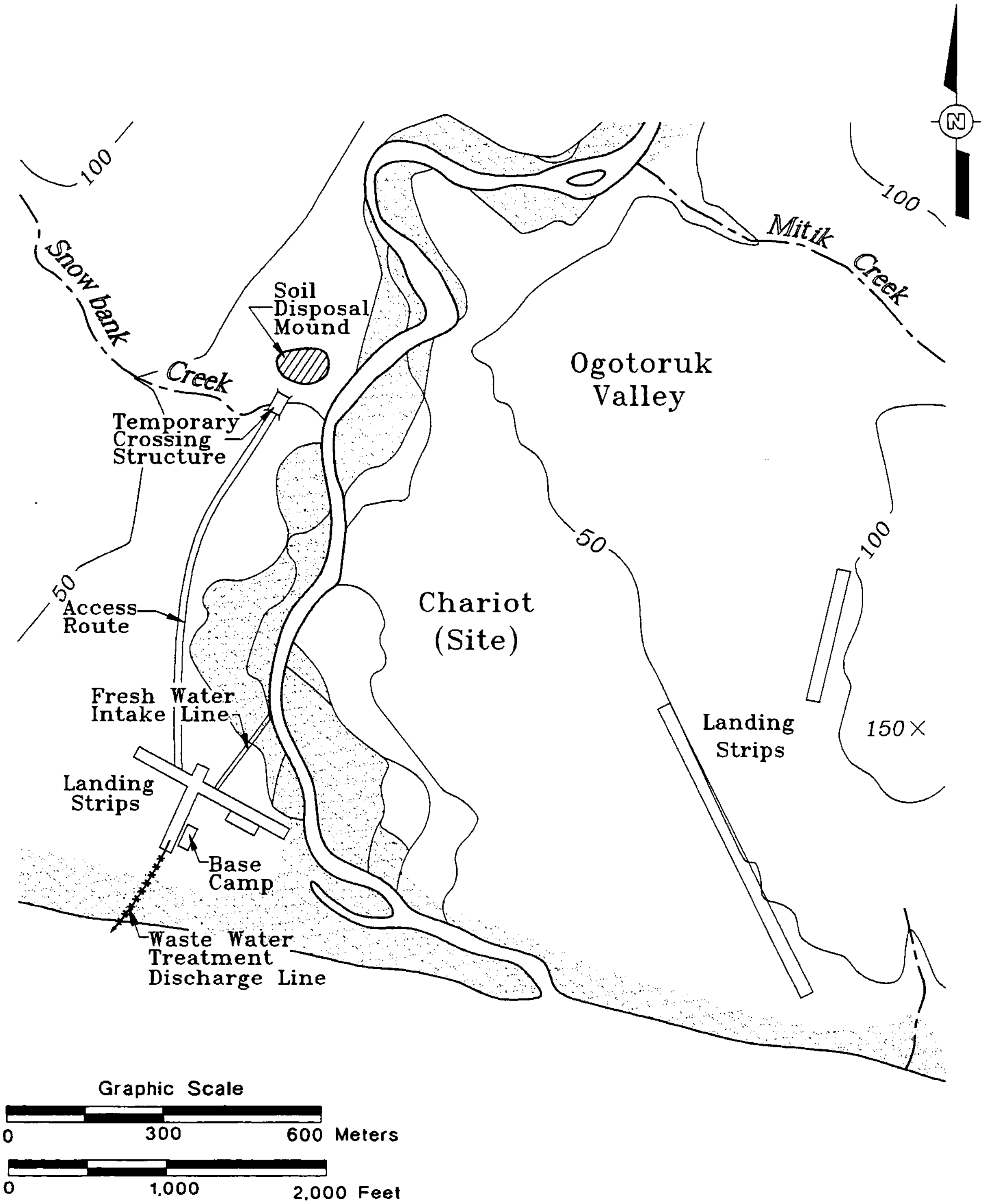


FIGURE 1-1
CAPE THOMPSON
REGION

Source: Wilimovsky and Wolfe, 1966



Notes:

1. Access Route, Temporary Crossing Structure, and Soil Disposal Mound are not drawn to Scale
2. The Access Route represents an approximate location. The actual route will be the existing route, which can not be exactly identified from existing information.
3. The base camp, fresh water intake line, and waste water treatment discharge line represent approximate locations and are not to scale.

FIGURE 1-2
PROJECT
CHARIOT SITE
LOCATION

DOE believes every accident and every injury is preventable. We will take every reasonable step to reduce the possibility of injury, illness, or accident.

This Site-Specific Health and Safety Plan (SSHASP) prescribes the procedures that must be followed during the site assessment, remedial action and related activities at the Project Chariot Site. Operational changes to this Plan, which could affect the health or safety of personnel, the public, or the environment, will not be made without the prior approval of the DOE and IT Project Managers and the Site Health and Safety (H&S) Officer.

The provisions of this plan are mandatory for all personnel assigned to the project. All visitors, oversight personnel, journalists, and others at the work site are also required to abide by the requirements of this plan.

1.5 References

This SSHASP complies with applicable Occupational Safety and Health Administration (OSHA), U.S. Environmental Protection Agency (EPA), and U.S. Department of Energy (DOE) regulations. This plan follows the guidelines established in the following:

- Relevant U.S. DOE Orders.
- *Standard Operating Safety Guides*, EPA, July 5, 1988.
- *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*, National Institute of Occupational Safety and Health, pp. 86-116.
- *Code of Federal Regulations* (C.F.R.), Title 29, Part 1910.120, U.S. Department of Labor OSHA.
- *Code of Federal Regulations* (C.F.R.), Title 29, Part 1926, U.S. Department of Labor, Construction.
- *Hypothermia and Cold Stress*, LLoyd, E. L., 1986.
- *Hypothermia: the Facts*, Collins, K. J., 1983.
- *Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices*, American Conference of Governmental Industrial Hygienists, 1991-1992.

- Helfer, I. and K. Miller, 1988, "Calibration Factors for Ge Detectors Used for Field Spectrometry," *Health Physics Journal of the Health Physics Society,* Vol. 55, No. 1 (July), pp. 15-29.

2.0 Responsibilities

2.1 All Personnel

All personnel at the Project Chariot Site are responsible for the safety and health of themselves and their coworkers; for completing tasks in a safe manner; and reporting any unsafe acts or conditions to their Supervisor and/or the Site Superintendent. All personnel are responsible for continuous adherence to these H&S procedures during the performance of their work. No person may work in a manner that conflicts with the letter or the intent of the safety, health, and environmental precautions expressed in these procedures. All on-site personnel will be trained in accordance with 29 C.F.R. 1910.120 and this document.

2.2 DOE Project Director

The DOE Project Director is responsible for press, regulatory, and public interface on the Project Chariot Site, including the authorization of visitors on the site, either in the base camp or the operational locations.

2.3 IT Project Manager

The IT Project Manager is ultimately responsible for ensuring that all project activities are completed in accordance with requirements set forth in this plan, and general safe operating practices. The IT Project Manager must perform at least one on-site safety review during the project. The IT Project Manager is responsible for ensuring all near misses, accidents and incidents on the project are reported and thoroughly investigated. The IT Project Manager must approve in writing any addenda or modifications to this SSHASP.

2.4 DOE Project Manager

The DOE Project Manager will provide oversight of the implementation of this SSHASP, and immediately notify the IT Project Manager of any deficiencies noted. Additionally, the DOE Project Manager must approve in writing any addenda or modifications to this SSHASP.

2.5 Site Superintendent

The Site Superintendent will be responsible for field application of this SSHASP. This will include communicating site requirements to all on-site project personnel in consultation with the Program H&S Officer. The Site Superintendent will be responsible for informing the Site

H&S Officer and the IT Project Manager of any changes in the work plan, so that those changes may be properly addressed. Other responsibilities include:

- Stopping work, as required, to ensure personal safety and protection of property, or where life or property-threatening noncompliance with safety requirements are found. Any stop work order must be reported immediately to the IT and DOE Project Managers.

- Notifying local public emergency officers of the nature of the site operations, and posting of their telephone numbers (or other contact information) in an appropriate location.

2.6 Site Health and Safety Officer

The Site H&S Officer provides on-site H&S support to the Site Superintendent for monitoring health risks and hazards, regulatory information, and other relevant site information. The Site Superintendent retains responsibility for the safe operation of the project, but should actively seek the assistance and advice of the Site H&S Officer in H&S matters.

The responsibilities of the Site H&S Officer include preparation and modification of this SSHASP. Any changes to the SSHASP must be approved by the Site H&S Officer. The Site H&S Officer will advise IT and DOE Project Managers on health and safety issues and establish and oversee the project air and personnel monitoring programs. The Site H&S Officer is the designated regulatory contact on matters related to occupational H&S. Other responsibilities include:

- Enforcing the requirements of the SSHASP, including performing daily safety inspections of the work site.

- Evaluating the effectiveness of the SSHASP. This includes performing daily safety inspections of the work site.

- Stopping work, as required, to ensure personal safety and protection of property, or where life or property-threatening noncompliance with safety requirements is found. Any stop work order issued must be reported at once to the DOE and IT Project Managers.

- Observing on-site project personnel for signs of stress, illness, or injury.

2.7 Site Health Physics Technician

The Site Health Physics Technician provides on-site health physics support to the Site H&S Officer for radiologic monitoring of personnel, identifying radiologic health risks and hazards, providing regulatory information related to health physics matters. The Site Superintendent retains responsibility for the safe operation of the project, but should actively seek the assistance and advice of the Health Physics Technician in health physics matters. Other responsibilities include:

- Evaluating the effectiveness of the health physics program, including monitoring, administrative controls, and decontamination.

- Stopping work, as required, to ensure personnel safety and protection of property, or where life or property-threatening noncompliance with safety requirements are found.

- Operating and maintaining radiation monitoring instruments, and performing radiation monitoring activities for sample shipment, and equipment and personnel clearance.

2.8 Subcontractors

On-site subcontractors and their personnel are responsible for understanding and complying with all site requirements. Local citizens hired to provide support services (e.g., bear guards) are considered to be subcontractors for the purposes of this SSHASP. Subcontractors are required to follow the guidelines established in IT's *Safety Rules for Contractors*, which is provided when contracted for work, and this SSHASP.

2.9 On-Site Personnel and Visitors

All on-site personnel are required to read this SSHASP, and acknowledge their understanding and compliance with it. All site project personnel are expected to abide by the requirements of the plan and cooperate with site supervision in ensuring a safe and healthful work site. Site personnel are required to immediately report any of the following to the Site H&S Officer:

- Accidents and injuries, no matter how minor
- Any unsafe or malfunctioning equipment
- Any unsafe conditions or acts
- Any changes in site conditions, which may affect the safety or health of project personnel
- Use of prescription or non-prescription drugs or medications.

No alcoholic beverages, marijuana, or illegal drugs are permitted in the camp or anywhere on the Project Chariot Site at any time. Possession or consumption of alcoholic beverages, marijuana or illegal drugs is cause for immediate dismissal from the site.

This page intentionally left blank

3.0 Job Hazard Analysis

Scope of Work

The scope of the Project Chariot site assessment and remedial action focusses exclusively on the removal of the soil disposal mound at the site; the performance of a radiological survey of the test plot areas; the sampling and analysis of surface water and sediment of Snowbank and Ogotoruk Creeks; and collection of biota samples in and around the Ogotoruk Valley. Operations will consist of:

- Sampling and analysis of the mound soil for waste stream classification
- Concurrent sampling and analysis of surface water and sediment for radiologic constituents
- Soil excavation and containerization
- Post-excavation sampling and analysis
- Transportation and disposal of excavated materials
- Collection of plant and animal specimens in and around the Ogotoruk Valley including birds, mammals, and a variety of plant species.

The Base Camp is excluded from consideration as a regulated area under the scope of Title 29 of the Code of Federal Regulations, Part 1910, Section 120, Hazardous Waste Operations and Emergency Response (29 C.F.R. 1910.120 or HAZWOPER) or this remediation and sampling operation. All potentially contaminated personnel or equipment must be decontaminated prior to exit from the Contamination Reduction Zone (CRZ) or entry into the Base Camp area for personnel not included in remediation operations (see Section 7).

The following sections present a description of the various hazards that may be encountered on the Project Chariot Site. Section 4.0, Hazard Control Program, presents the various protective measures to be used to mitigate these hazards.

3.1 Physical Hazards

The primary physical hazards for this project are associated with the use of earth-moving equipment and supporting vehicles. Physical hazards specific to these operations are outlined below.

3.1.1 Motor Vehicle Operations

All-terrain vehicles (ATVs) will be used for transportation at the site. Each ATV operator will receive training in the safe operation of the vehicle at the start of project operations. Additionally, no more than one passenger, in addition to the driver, will be permitted on a single ATV.

3.1.2 Heavy Equipment Operations

A backhoe, front-end loader and other heavy equipment will be used on this site. These pieces of machinery present hazards to site workers due to the limited visibility of the operator, noise, and confined area of operations. All such vehicles shall:

- be equipped with back-up alarms
- be equipped with a fire extinguisher
- be assisted by a spotter with radio or hand-signal communication with the operator
- be inspected daily before operations commence for proper operation, safety equipment, and loose connections. The daily inspection shall be observed by the Site H&S Officer, and recorded in the field activity daily log.

3.1.3 Heat Stress

Heat stress is not expected to present a hazard at this location.

3.1.4 Cold Stress

Cold and/or wet environmental conditions can place workers at risk of a cold-related illness. Hypothermia can occur whenever temperatures are below 7.2 degrees Celsius (°C) (45 degrees Fahrenheit [°F]), and is most common during wet and windy conditions, with temperatures between 4 and -1°C (40 and 30°F). The principal cause of hypothermia in these conditions is loss of insulating properties of clothing due to moisture, coupled with heat loss due to wind and evaporation of moisture on the skin.

Frostbite, the other illness associated with cold exposure, is the freezing of body tissue, which ranges from superficial freezing of surface skin layers to deep freezing of underlying tissue. Frostbite will only occur when ambient temperatures are below 0°C (32°F). The risk of frostbite increases as the temperature drops and wind speed increases.

The specific procedures, limits of operation, and controls to be used by the Site H&S Officer for management of cold stress are discussed in detail in the American Conference of Governmental Industrial Hygienists (ACGIH) publication *Threshold Limit Values (TLV) for Chemical and Physical Agents and Biological Exposure Indices*, current edition. The actual air temperature and wind speed will be monitored on site and will be applied to field operations at the Project Chariot Site. Personal protective equipment (PPE) and administrative controls will be modified in accordance with the ACGIH recommendations.

3.1.5 Hazardous Materials

No *in situ* chemical hazards are anticipated on this site.

3.1.6 Radiological Hazards

Based on reported materials used in the Project Chariot tracer study, the following radioactive contaminants potentially exist at the site:

- Cesium-137

- Sedan fallout, the radionuclides that may remain are principally Cesium-137, with minor trace amounts of Strontium-90, Cobalt-60, Europium-152, Europium-155, Plutonium-239, and Americium-241. See Appendix C of the Site Assessment and Remedial Action Plan for a more thorough discussion of the radionuclides found in the Sedan fallout.

The types of radiation that may be encountered during site operations are:

- Alpha
- Beta
- Gamma.

The potential types of hazards from these radiations are both external and internal. Alpha particles represent an internal hazard only, while the beta and gamma radiations may present both an external and internal hazard. Internal hazards are avoided by personal hygiene techniques, preventing ingestion by not eating, smoking, and drinking in potentially hazardous areas, and wearing respiratory protection when airborne levels exceed minimum concentrations. External hazards from either beta or gamma radiation can be minimized by reducing time in exposure areas or by maintaining distance from the source of exposure. Shielding may be employed to further reduce exposure. Beta shielding may be accomplished using several layers of clothing, gloves, and goggles. Gamma shielding usually requires a dense material such as lead or concrete.

The basic protective measures to be implemented when working near or handling radioactively contaminated materials are:

- Time
- Distance
- Shielding
- Protective clothing
- Personal Hygiene.

Supervisors can limit the time of each individual exposure to prevent overexposure to radiation during work shifts and for the entire project. For each twofold increase in distance from the source, exposure decreases by as much as a factor of four. Shielding materials such as plastic for beta radiation and lead or concrete for gamma radiation may be used to further reduce exposure. Shielding for beta radiation may also be accomplished with protective clothing, gloves, and safety goggles or glasses.

3.2 Isolation

Some sample collection activities will take place away from the majority of site operations in Ogotoruk Valley and adjoining areas. Workers in these remote areas must be accompanied by a bear guard, and must maintain radio communication with the base camp. Additionally, each group leaving the Ogotoruk Valley or going to remote areas of the valley, must report to the base camp administrator their location, activities, and estimated time of return prior to their departure. They must also report their return to the base camp administrator.

3.3 Noise

Noise exposure at or above the OSHA action level of 85 decibels [dBA] is likely during heavy equipment operations. Exposure to noise levels in excess of 90 dBA, the OSHA permissible exposure limit (PEL) for noise, is possible. A hearing conservation program is required for this project.

Exposure to noise over the OSHA action level can cause temporary impairment of hearing; prolonged and repeated exposure can cause permanent damage to hearing. The risk and severity of hearing loss increases with the intensity and duration of exposure to noise. In addition to damaging hearing, noise can impair voice communication, thereby increasing the risk of accidents on site. Therefore, hearing protection will be required if noise levels exceed 85 dBA for any worker on the site.

3.4 Biological Hazards

The primary biological hazards on the site are expected to be the possible presence of the grizzly bear (*Ursus arctos*) or polar bear (*Thalarctos maritimus*), and various small mammals which may carry rabies and/or attract bears. Other animals that may be found in the area, musk oxen and caribou, are not expected to present a hazard to site personnel.

3.5 Aircraft Operations

Aircraft may be used in personnel and/or equipment transportation on this project. All appropriate Federal Aviation Administration (FAA), U.S. Department of Transportation (DOT), and DOE safety regulations will be used to assure safe operation of aircraft.

This page intentionally left blank

4.0 Hazard Control Program

In response to the job hazards identified in Section 3.0, the following work practices will be observed during all site activities.

4.1 General Practices

- At least one copy of this SSHASP shall be available at the project site, in a location readily available to all personnel.
- Potentially contaminated protective equipment, such as gloves and boots, shall not be removed from the regulated area until it has been cleaned or properly packaged and labeled and surveyed for radiologic contamination.
- Removal of contaminated soil from protective clothing or equipment by blowing, shaking, or any other means that disperse contaminants into the air is prohibited.
- No food or beverages shall be present or consumed in the Exclusion Zone (EZ).
- No smoking in indoor areas.
- No tobacco products shall be present or used in the EZ or CRZ.
- Feeding, touching, or otherwise molesting animals is strictly prohibited.
- Cosmetics shall not be applied within the EZ, or CRZ.
- Potentially contaminated materials shall be stored in tightly closed containers, in well-ventilated areas.
- Containers shall be moved only with the proper equipment, and shall be secured to prevent dropping or loss of control during transport.
- Emergency equipment, including an eye wash station, first aid kit, and fire extinguisher, will be located outside storage areas in readily accessible locations that will remain minimally contaminated in an emergency.
- All areas that have been determined as uncontaminated inside the EZ or CRZ will be clearly marked as such. No personnel or equipment shall be in these areas until they have been decontaminated.
- Good housekeeping shall be maintained at all times.

- Visitors to the site must abide by the following:
  - All visitors will be instructed to stay outside the contaminated area (Exclusion and Contamination Reduction zones during the extent of their stay. Visitors shall be cautioned to avoid contact with animals and contaminated or suspected contaminated surfaces, equipment or areas. For the protection of site visitors, a visitor observation area will be identified and demarcated, which will provide an unobstructed view of the soil excavation operations.
  - Visitors requesting to observe work conducted in the EZ must provide and wear appropriate PPE, as well as produce evidence of at least 24 hours of training as specified in 29 C.F.R. 1910.120(e), current refresher training, and current participation in a medical monitoring program compliant with 29 C.F.R. 1910.120 (f) prior to entry into that zone. If respiratory protective devices are necessary, visitors who wish to enter the EZ must produce evidence that they have had a complete physical examination, respirator training, and have been fit tested for a respirator within the past 12 months, and provide their own respiratory protective equipment.
  - Visitor inspection of the contaminated area shall be at the discretion of the Site Superintendent.
- Portable radios will be provided to site personnel, selected by the Site Superintendent, for routine and emergency communications among excavation, sampling, and support personnel. All transmissions will be kept clear and concise; jokes, profanity or other verbal horseplay are not permitted.

4.1.1 Buddy System

- All operations personnel on site shall use the buddy system (working in pairs or teams). If protective equipment or noise levels impair communications, then prearranged hand signals shall be used for communication. Visual contact shall be maintained between crew members at all times, and crew members must observe each other for signs of stress. Indication of adverse effects include, but are not limited to:
  - Changes in complexion and skin coloration
  - Changes in coordination
  - Changes in demeanor
  - Changes in speech pattern.
- No personnel will work on site if they are not within line of sight of another team member.

4.2 General Equipment Operation Practices

- Fire fighting equipment must not be tampered with and must not be removed for other than the intended fire-fighting purposes or for servicing.

- If lubrication fittings are not accessible with guards in place, machinery should be stopped, and the motor turned off for oil and greasing.

- Rigging and equipment for material handling must be checked prior to use on each shift and as often as necessary to ensure it is safe. Defective rigging shall be removed from service.

- Work areas should not be obstructed.

4.2.1 Equipment Decontamination

High-pressure steam washers will be used for heavy equipment decontamination. These operations present slipping hazards on wet plastic, the danger of burns from the hot steam, splash hazards, and the danger of physical trauma from the high-pressure steam spray. Decontamination personnel will be provided with water resistant coveralls or rain suit, safety glasses, nitrile over latex or polyvinyl Chloride (PVC) gloves, and an acetate face shield during decontamination operations (see SOP-CHR-04, Field Decontamination).

4.2.2 Transportation Operations

- The basket or forks of heavy equipment must not be raised until the equipment has been cleared by the spotter of other personnel and obstructions.

- Soil containers should not be picked up suddenly, rather they should be lifted with a steady, constant force.

- The brakes, backup alarm, and lights of heavy equipment should be tested by each operator when he comes on shift to determine whether they are in good order. The entire machine should be thoroughly inspected by a competent individual each week, and the results documented on a Field Activity Daily Log (FADL).

- Workers should never stand near (within 4.6 m [15 ft] of) the equipment when any lifting, digging, or transportation operation is in progress.

4.2.3 Riding Equipment

- Under no circumstances will personnel be permitted to ride the bucket or forks, nor will earth-moving or container handling equipment be used as a personnel carrier.

4.2.4 Container Handling

- Workers are not permitted on top of the load during loading, unloading, or transferring of soil containers.

- Soil containers should be inspected for structural integrity before transport, whether filled, partially filled, or empty.

- All containers should be labeled as to contents as soon as possible or at the end of each shift.

- All personnel are to remain clear of soil containers when the containers are being handled.

- Gloves must be worn when manually cleaning, sampling, or otherwise working on the soil containers.

4.3 Aircraft Operations

Both fixed wing and rotorcraft may be used on the Project Chariot Site. A radio base-station capable of communicating with aircraft will be stationed on the site to provide meteorological and physical information to approaching aircraft. A wind sock and a meteorological station equipped to monitor wind speed, direction and air temperature will be placed on the site to assist in the safe operation of aircraft. The site will also be equipped with a strobe light to assist in the location of the site from the air.

4.3.1 Helicopters

Helicopter cranes, if used on this site, will be expected to comply with any applicable regulations of the FAA. Prior to each day's operation, a briefing will be conducted that sets forth the plan of operation for the pilot and ground personnel. Additionally, a specific landing area will be identified and marked with a large cross at the beginning of site operations. The following specific requirements apply to helicopter operations:

- Loads shall be properly slung. Tag lines shall be of a length that will not permit their being drawn up into the rotors. Pressed sleeve, swedged eyes, or equivalent means shall be used for all freely suspended loads to prevent hand splices from spinning open or cable clamps from loosening.

- All electrically operated cargo hooks shall have the electrical activating device so designed and installed as to prevent inadvertent operation. In addition, these cargo hooks shall be equipped with an emergency mechanical control for releasing the load. The site Superintendent shall ensure that the hooks are tested prior to each day's operation by a competent person to determine that the release functions properly, both electrically and mechanically.

- PPE shall be provided and used by employees receiving the load. PPE shall consist of safety glasses, hearing protection, and hardhats secured by chinstraps. Loose-fitting clothing likely to flap in rotor downwash, and thus be snagged on the hoist line, may not be worn.

- All loose gear within 30 m (100 ft) of the place of lifting the load or depositing the load, or within all other areas susceptible to rotor downwash, shall be secured or removed. Good housekeeping shall be maintained in all helicopter loading and unloading areas.

- The size and weight of loads and the manner in which loads are connected to the helicopter shall be checked. A lift may be aborted if the helicopter operator believes the lift cannot be made safely.

- When employees perform work under hovering craft, a safe means of access shall be provided for employees to reach the hoist line hook and engage or disengage cargo slings. Employees may not be permitted to perform work under hovering craft except when necessary to hook or unhook loads.

- Static charge on the suspended load shall be dissipated with a grounding device before ground personnel touch the suspended load, unless adequate protective rubber gloves are being worn by all ground personnel who may be required to touch the suspended load.

- The weight of an external load shall not exceed the helicopter manufacturer's rating.

- Hoist wires or other gear, except for pulling lines or conductors that are allowed to "pay out" from a container or roll off a reel, shall not be attached to any fixed ground structure, or allowed to foul on any fixed structure.

- Ground personnel shall be instructed and the Site Superintendent shall ensure that when visibility is reduced by snow or other conditions, they shall exercise special caution to keep clear of main and stabilizing rotors. Precautions shall also be taken by the Site Superintendent to eliminate, as far as practical, the snow or other conditions reducing the visibility.

- The Site Superintendent shall instruct the aircrew and ground personnel on the signal systems to be used, and shall review the system with the employees in advance of hoisting the load. This applies to both radio and hand signal systems.

- No employee shall be permitted to approach within 15 m (50 ft) of the helicopter when the rotor blades are turning, unless his work duties require his presence in that area.

- The Site Superintendent shall instruct personnel and shall ensure that whenever approaching or leaving a helicopter that has its blades rotating, all personnel shall remain in full view of the pilot and keep in a crouched position. No personnel shall be permitted to work in the area from the cockpit or cabin rearward while blades are rotating, unless authorized by the helicopter operator to work there.

- Sufficient ground personnel shall be provided to ensure that helicopter loading and unloading operations can be performed safely.

- There will be constant reliable communication between the pilot and a designated member of the ground crew who acts as a signalman during the period of loading and unloading. The signalman shall be clearly distinguishable from other ground personnel.

- Open fires shall not be permitted in areas where they could be spread by the rotor downwash.

4.4 Cold Illness Prevention

4.4.1 Cold Stress

Most cold-related worker fatalities have resulted from failure to escape low environmental air temperatures, or from immersion in low temperature water. The single most important aspect of life-threatening hypothermia is a reduction in the core temperature of the body.

Site workers should be protected from exposure to cold so that the core temperature does not fall below 36.0°C (96.8°F). Lower body temperatures will very likely result in reduced mental alertness, reduction in rational decision making, or loss of consciousness with the threat of fatal consequences. To prevent such occurrence, the following measures will be implemented:

- Site workers shall wear warm clothing (e.g., mittens, heavy socks, and thermal underwear) when working below 7.2°C (45°F). Protective clothing, such as Tyvek®, Polyvinyl chloride (PVC) or other disposable coveralls, may be used to shield employees from the wind.

- When the air temperature is below 1.7°C (35°F) additional clothing for warmth will be worn by employees in addition to radiological protective clothing, if required, This may include:

  - Insulated suits, such as insulated coveralls and whole body thermal underwear
  - Wool socks over polypropylene socks to keep moisture off the feet
  - Insulated gloves

- Insulated head cover, such as a knit cap
- Insulated parka, with hood and wind and water resistant outer layer
- Insulated pants, with wind and water resistant outer layer
- Insulated safety boots.

- At air temperatures below 1.7°C (35°F), the following work practices must be implemented:

  - If the clothing of a site worker might become wet on the job site, the outer layer of clothing must be water impermeable.

  - If a site worker's underclothing becomes wet in any way, the worker must change into dry clothing immediately. If the clothing becomes wet from perspiration (and the employee is not uncomfortable), the employee may finish the task at hand prior to changing into dry clothing.

  - Site workers will be provided with a warm (18°C [65°F] or above) break area.

  - Hot liquids, such as soups or warm, sweet drinks, shall be provided in the break area. The intake of coffee and tea should be limited, due to their circulatory and diuretic effects. Meals should be taken at 4- to 6-hour intervals to assist in temperature regulation.

  - The buddy system shall be practiced at all times on site. Any site worker observed with severe shivering shall leave the work area immediately.

  - Site workers should dress in layers, with thinner lighter clothing worn next to the body.

  - Site workers should avoid overdressing when going into warm areas or when performing strenuous activities. In addition, work should be planned and executed so as to minimize sweating.

  - Employees handling liquids that rapidly evaporate, such as gasoline, diesel fuel, or kerosene, shall take special precautions to avoid soaking of gloves and clothing with those materials.

4.4.2 Symptoms of Hypothermia

<u>Mild Hypothermia (Core Temperature 35°C [95°F])</u>

Pallor

Shivering

Lack of coordination or weakness

Dulled mental state

Moderate Hypothermia (Core temperature 34-30°C [93-86°F])
Pallor
Reduced/no shivering
Slow, weak pulse
Weak breathing (<10 breaths per minute)
Unconsciousness between 32-30°C (90-86°F) core temperature

Severe Hypothermia (Core temperature <30°C [<86°F])
Unconsciousness
Skin very cold to touch
Extreme pallor
Generalized rigidity of limbs, neck
Slow or no pulse
Blue patches of skin
Puffy appearance of skin
Minimal breathing

Treatment varies for hypothermic patients. Application of warm blankets and *immediate medical treatment* is critical to the survival of the victim. Any signs of hypothermia should be treated as a medical emergency.

4.4.2.1 Frostbite

Frostbite is characterized by waxy, firm skin, usually of the extremities (e.g., nose, cheeks, and ears). As the tissues are actually frozen (varying in degree from frostnip to frostbite), rubbing of the affected tissue *is not recommended.* Immediate medical treatment is necessary; severe frostbite can lead to complications including gangrene, amputation, or even death.

4.5 Hearing Conservation

All on site personnel shall wear hearing protection, with a Noise Reduction Rating (NRR) of at least 20, when noise levels exceed 85 dBA. All site personnel who may be exposed to noise shall also receive baseline and annual audiograms and training as to the causes and prevention of hearing loss. Noise monitoring is discussed in Chapter 8.

Whenever possible, equipment that does not generate excessive noise levels will be selected for this project. If the use of noisy equipment is unavoidable, barriers or increased distance will be used wherever possible to minimize worker exposure to noise.

4.6 Chemical Hazards

While no chemical hazards are anticipated in the environment, sample preservatives, such as nitric acid and fuels such as gasoline, diesel, or kerosene, will be brought to Cape Thompson to supply site operations. Material Safety Data Sheets for these materials are presented in Attachment A. All sample containers will be handled carefully during sample collection to avoid contact with acid preservative. Additionally, safety glasses, and latex, PVC or outer nitrile gloves will be worn during sample collection and handling activities. Exposure to nitric acid will result in itching or burning sensations of the skin, and/or irritation or burning of the eyes or mucus membranes. Affected areas must be flooded with water for at least 15 minutes, and medical assistance sought if necessary.

Fuel materials, such as diesel, gasoline, or kerosene, exhibit narcotic effects when inhaled, are very flammable, and their high volatility (in the cases of gasoline and kerosene) may cause cold injury to exposed skin due to rapid evaporation. Defatting of the skin may also result from prolonged exposure. Personnel must exercise great care when handling these materials to identify and extinguish or remove all ignition sources, provide adequate ventilation, and avoid skin contact when handling these fuels. These materials may cause lightheadedness, irritation of the eyes, or irritation of the skin when contacted. If exposed, the victim should be removed to fresh air, affected areas flushed with water (for at least 15 minutes if the eyes have been splashed), and medical assistance summoned at once.

4.7 Biological Hazards

One person will be assigned duty for bear guard at the base camp during all site operations and a guard will accompany personnel performing biota, sediment and surface water sampling, and radiological surveys. An unloaded weapon will be kept in the CRZ, to be loaded only if a bear is sighted in the area. Any nonlocal personnel acting as bear guards are required to complete an accredited firearms safety course prior to arrival at the site. A certificate or other evidence of successful completion will be kept on site.

All possible measures will be taken to avoid disturbing or interfering with bears in the area. Site operations will be suspended, and all personnel moved to shelter if a bear is observed in the immediate area of the site operations. The bear guards will destroy bears *only* if the animals present an *immediate* threat to site personnel. *Avoidance of contact with the animals will be the standing policy for all operations*. If an attack does occur to an unarmed individual, the attacked person should drop to the ground in a fetal position, protecting the head area with the arms, and attempt to remain motionless. *Do not attempt to outrun the attacking bear.*

Another hazard is the possible presence of small mammals (e.g., foxes and squirrels) on site. Any feeding, molesting or other contact with these animals is expressly prohibited. In addition to the possibility the animals may be infected with rabies, attracting the animals by feeding them may also attract bears. All food, garbage, or scraps must be protected from both bears and small mammals at all times. Policing of the camp area will be monitored by the Site H&S Officer.

4.8 Sanitation

The following rules apply for all project field operations:

4.8.1 Potable Water

- An adequate supply of potable water will be provided at the work site.
- Portable containers used to dispense drinking water shall be capable of being tightly closed, and shall be equipped with a tap dispenser. Water shall not be drunk directly from the container.
- Containers used for drinking water shall be clearly marked and not used for any other purpose.
- Disposable cups will be supplied; both a sanitary container for unused cups and a receptacle for disposing of used cups shall be provided.

4.8.2 Nonpotable Water

- Outlets for nonpotable water shall be identified to clearly indicate that the water is unsafe and is not to be used for drinking, washing, or cooking purposes.

- There shall be no cross connection (open or potential) between potable and Nonpotable water systems

- Nonpotable and potable water systems shall be separately located to minimize confusion and cross contamination.

4.8.3 Toilet Facilities

Toilet facilities shall be available for employees as follows:

Table 4-1
Toilet Facilities

Number of Employees	Minimum Number of Facilities
20 or fewer	One
More than 20, fewer than 200	One toilet seat and one urinal per 40 employees

4.8.4 Trash Collection

Trash collected from the CRZ will be separated from other waste and disposed in soil disposal containers. Trash collected in the support zone, break area(s), and camp will be disposed of as domestic waste. Labeled trash receptacles will be set up in the CRZ and in the support zone. Trash that may contain food or kitchen waste will be segregated from other trash and collected at a distance from the camp or work area. Such trash will be containerized to reduce the possibility of disturbance by bears. All domestic waste will be incinerated on site daily by the camp service contractor.

4.9 Firearms

Firearms will be present on site for the following purposes:

- Bear protection
- Avian specimen collection
- Small mammal specimen collection.

Provision of bear guards is strictly for the protection of site personnel in extreme circumstances. Hunting and target shooting, for any reason, is specifically prohibited on or around the site. No firearms other than those required for the above purposes are permitted on the site. All firearms shall be unloaded, and the ammunition stored in a separate location from the firearm and under the care of the Site H&S Officer, when not directly guarding site personnel. The Site H&S Officer shall verify, and so note in the field log, the transfer of ammunition, and any expenditure of ammunition, during the course of field operations. ***Any horseplay involving firearms, pointing firearms at any person whether loaded or unloaded, shall be cause for IMMEDIATE dismissal from the site.***

A small caliber handgun (not greater than 0.25 caliber) may be required during mammal collections. The gun is to be carried and used only by the senior task leader who is also responsible for locking the gun in the project office at night. The gun will not be loaded until IMMEDIATELY prior to use and will be unloaded IMMEDIATELY after use. When not in use the safety will be engaged and the trigger lock applied. The firearm will not be carried at any other time or in any other place, except as needed for use in mammal collection.

A 12 gauge shotgun will be required for avian specimen collection. The shotgun is to be carried and used only by the senior task leader, who will be responsible for keeping it securely locked away at night in the project office gun cabinet. Because of the noise caused by loading the shotgun it may be loaded prior to use. The safety will be engaged at all times until immediately prior to use and it will be reengaged immediately following use. The firearm will not be loaded during vehicle transport to and from the collection site. DISCHARGING THE SHOTGUN FROM ON OR IN THE VEHICLE IS NOT ALLOWED. The user will remain aware of what is behind the target to ensure that he does not endanger surrounding areas. The firearm will be carried with the muzzle pointed up toward the sky and away from the worker or other personnel. All remaining members of the sampling team will be required to stay directly behind the task leader during use of the firearm. When two or more sampling teams are in operation, each team will verify direction of fire and separation of teams via radio with the Site Superintendent and all other teams. No firing is permitted if communication cannot be established with other teams on site. When the firearm is not in use the trigger lock will be in place.

The avian specimen collection activity will be coordinated by the Site Superintendent and Site H&S Officer to ensure no other activities are being conducted in the collection area, specifically down-range in the field of fire. The task leader will provide the Site Supervisor and the Site H&S Officer a detailed map of the area identifying for each sampling event the:

- Sampling location(s)
- Field(s) of fire
- Schedule of collection.

All collection activities will be performed in outward-bound routes from the base camp and other site activities.

A log shall be maintained on site recording each use of the firearm(s), including the name of the user, date, time and location of use, number of times discharged and for what purpose, and the time removed from locked storage and time returned to locked storage. Each use entry in the log shall be countersigned by the Site Superintendent or designee, and shall include a count by that individual of the number of cartridges issued to the user, number of rounds expended, and number of rounds remaining in the supply.

At no time are the firearms to be used for any other purpose than sample collection or bear protection. Any horseplay involving the firearms, or misrepresentation of their use, in the opinion of the IT Project Manager or an accident review board convened by DOE and/or the IT Project Manager, shall be considered grounds for termination of the involved IT employee(s) or immediate dismissal from the site of any other person. No firearms other than those described above are allowed on site at any time; and no automatic or semi-automatic firearms are permitted. Possession of a firearm other than those described above, shall be grounds for immediate ejection of the involved person(s) from the site, and possible subsequent disciplinary action.

It is the responsibility of the Site Superintendent to assure users of firearms have attended an accredited firearm safety course, and proof of such training shall be available on site, or on file with the Site H&S Officer.

Any deviation from the requirements placed upon firearm operation or handling will result in the Site Health and Safety Officer immediately shutting down all operations on the site.

4.10 Bonding and Grounding

Liquid transfer operations involving fuels and other flammable materials involve potential generation of a static spark, which may provide an ignition source. For this reason, all fuel containers must be electrically bonded prior to liquid transfer. Bonding will be accomplished by the use of copper bonding cables. When transferring flammable liquids, the following procedure must be used:

- Assure a paint-free, firm connection point on the container or equipment being fueled, and the fuel supply container
- Connect the bonding cable to the container or equipment being fueled
- Connect the other end of the bonding cable to the fuel source container
- Transfer the fuel or flammable liquid
- Cap or cover both flammable liquid containers
- Remove bonding cable.

5.0 Personal Protective Equipment

Based upon the job hazard analysis, it is expected that project personnel will not need extensive protective clothing and that the on-site work can be completed in Level D or modified Level D protective clothing. If conditions warrant higher levels of protection, site work will be suspended until those conditions can be adequately characterized and the appropriate protection provided. Level D protection includes:

- Long pants and long-sleeved shirt
- Warm outer clothing, waterproof if appropriate
- High-visibility vest with retroreflective stripes on front and back
- Safety glasses or goggles (approved by the American National Standards Institute [ANSI])
- Safety-toed boots (ANSI-approved)
- Hard hat, with helmet liner and chin strap, if appropriate
- Hearing protection with a EPA NRR of at least 20 dBA where ambient noise levels are at or greater than 85 dBA.

5.1 Respiratory Protection Program

A site respiratory protection program is not anticipated as the level of protection is not expected to exceed Level D. If monitoring results indicate a higher level of protection is warranted, a respiratory protection program will be developed and implemented. An exception will be made for laborers handling sorbent materials with significant dusting, the laborers will be permitted to wear disposable half-face respirators.

5.2 Using Personal Protective Equipment

Depending upon the level of protection selected for this project, specific donning and doffing procedures may or may not be required. Level D operations may be modified to include disposable protective outer garments and gloves if working conditions (muddy conditions) or monitoring results indicate their advisability. If disposable outer garments and gloves are put to use, the procedures described in Sections 5.3.1 and 5.3.2 are mandatory.

All persons entering the EZ shall put on the required PPE in accordance with the requirements of this plan. When leaving the EZ, PPE will be removed in accordance with the procedures listed, in order to minimize the spread of contamination.

5.2.1 Donning Procedures

These procedures may be required for the project:

- Remove bulky outerwear. Remove street clothes and store in clean location.
- Put on work clothes or coveralls.
- Put on any required protective coveralls over work clothing.
- Put on protective boots or boot covers, if required by the Site H&S Officer.
- Tape the legs of the coveralls to the boots with duct tape.
- Put on protective gloves as required by the H&S Officer.
- Tape the wrists of the protective coveralls to the gloves.
- Don remaining PPE, such as hard hat, safety glasses or goggles.

If these procedures are instituted, one person shall remain outside the work area to ensure that each person entering has the PPE. No persons shall be allowed to enter the EZ if they are not wearing the required PPE.

5.2.2 Doffing Procedures

The following procedures are mandatory whenever a person leaves the EZ or when modified Level D apparel is employed:

- Upon entering the CRZ, clean gross mud and soil from boots.

- Remove protective garments. All disposable clothing should be placed in plastic bags, which are labeled appropriately.

- Remove plastic safety boots, and don regular shoes or boots.

- Wash face and neck as soon as possible.

- Proceed to clean area and dress in clean clothing.

- Proceed to the sign-out point.

All disposable equipment, garments, and PPE shall be placed in 6-milliliter (ml) plastic bags as a minimum and properly labeled for disposal.

5.3 Personal Protective Equipment Selection

The level of PPE selected will be based upon real-time monitoring of the work environment and an assessment by the Site H&S Officer of the potential for skin contact with contaminated materials.

6.0 Site Control

6.1 Authorization to Enter

Only personnel who have completed 24 or 40 hours of initial hazardous waste operations training as required under OSHA Regulation 29 C.F.R. 1910.120(e)(3), and refresher training (if required) within the past 12 months, and have been certified as fit for hazardous waste operations by a physician within the past 12 months shall be allowed within a site area designated as an EZ or CRZ. Personnel without this training (e.g., visitors and camp support personnel) may only enter the designated support zone. The Site Superintendent will maintain a list of authorized persons. Only personnel on the authorized personnel list will be allowed within the EZ or CRZ.

6.1.1 Other Site Workers

General site workers (radiation survey, surface water/sediment sampling and biota collection personnel) must have completed 40 hours of initial hazardous waste site operations training and refresher training as described in Section 6.1. Limited site workers must have completed 24 hours of initial and 8 hours of refresher training as described in Section 6.1. Limited site workers include surveyors, oversight and regulatory personnel and others with limited scope or duration of activities.

6.2 Hazard Briefing

No person will be allowed on the Project Chariot Site (base camp, Support Zone, CRZ, or EZ) during site operations without first being given a site hazard briefing. The briefing will consist of a review of the tailgate safety meeting form or a review of controlled area locations (EZ, CRZ, and Support Zone) for visitors confined to the base camp. All persons on the site, including visitors, must sign the site-specific tailgate safety meeting form to work at or visit any area other than the base camp.

6.3 Documentation of Certification

A training and medical file will be established for the project and kept on site during all site operations. The 40-hour training, refresher, and specialty training (first-aid/cardiopulmonary resuscitation [CPR], Emergency Medical Technician or Paramedic) certificates, as well as the current annual medical clearance for all project field personnel, will be maintained in that file.

All personnel seeking to enter the EZ, must provide their training and medical documentation to the Site Superintendent prior to the start of field work.

6.4 Entry Log

The Site Superintendent, or designee, shall record on the Field Activity Daily Log (FADL) all visitors to the site (all areas). A log-in/log-out sheet shall be maintained in the CRZ and personnel will sign in and out on the log as they enter and leave the CRZ. At the end of each shift, the log will be collected by the Site Superintendent for incorporation into the project file.

6.5 Entry Requirements

In addition to the entry requirements listed above, no personnel will be allowed on the Project Chariot Site (other than the base camp, delineated by the bear fence around the camp) unless they are wearing the minimum PPE as described in Chapter 5.0. Personnel entering the EZ or CRZ must wear the required PPE for those locations. All site entries are at the discretion of the Site Superintendent.

7.0 Decontamination

A CRZ for equipment and personnel will be established immediately outside the EZ. This area will also be delineated with barrier tape or rope. Each side of the decontamination zone will be posted with the following sign:

WORK AREA
NO UNAUTHORIZED ACCESS.

The remainder of the project area will be designated as the support zone. No special markings or warning labels are required for this area.

7.1 Personnel Decontamination

All personnel working in the EZ must undergo decontamination prior to entering the support zone. The personnel decontamination area shall consist of the following stations:

Station 1. Personnel leaving the EZ will remove the gross mud and soil from their outer clothing and boots. Personnel will be surveyed for radiological contamination. If personnel are contaminated, the Site Health Physics Technician will assist in removal of contaminated PPE, and re-survey for contamination.

Station 2. At Station 2, personnel will remove their boots, disposable rain gear and disposable gloves and deposit them in the lined waste receptacles. Personnel may then enter the break area or exit the CRZ. Supplies: Plastic-lined waste receptacle, chairs or bench, clean clothes, paper towels and plastic bags.

7.2 Equipment Decontamination

Any vehicles which have entered the EZ or CRZ including the backhoe, will be surveyed for radiological contamination prior to leaving the CRZ using a beta/gamma pancake probe held about 1 centimeter (cm) (0.4 inches [in.]) from the equipment surface. Gross soil will be removed from the treads, wheels, and bucket using hand tools. The equipment will then be pressure-washed on the decon pad to remove fine soil from the bucket, and three 100-square centimeter (cm^2) areas will be swipe sampled and counted for alpha and beta/gamma contamination. The release criteria for equipment is the same as for shipment of samples (specified in Section 8.3.5, Shipping).

7.3 Personal Protective Equipment Decontamination

Wherever and whenever possible and appropriate, single use, disposal protective clothing shall be used for work within the EZ or CRZ. This protective clothing will be disposed of in B-25 Low Specific Activity (LSA) soil disposal containers.

8.0 Site Monitoring

Monitoring will be performed with both real-time and passive monitoring devices. Action levels are described in Section 8.2. Monitoring procedures are described in Section 8.0. Air monitoring for all radiation hazards is described in Section 8.1.1.

8.1 External Exposure

A microroentgen (μR) meter will be used to assess gamma fields during operations. A μR meter can easily detect small increases in the gamma exposure above background. An ion chamber dose rate meter shall be available in the event that exposure rates are higher than the range of the μR meter. See action levels for expected range of exposures.

Thermoluminescent dosimeters (TLDs) will be required for each person working directly with soil removal. The TLDs must be National Volunteer Laboratory Accreditation Program (NVLAP)-qualified and capable of distinguishing a difference from background of 10 millirems (mrem). The dosimeters shall be worn outside of the clothing, on the front of the body between the waist and neck. The TLDs will be issued for the full duration of the soil removal activities. The results will be made available to each TLD wearer.

All samples, wastes, and shipments will be monitored with an instrument capable of measuring to 2 mrem to determine the radiation level. Handling of the materials will be in accordance with the action levels in Section 8.2.

8.2 Internal Exposure

An internal dosimetry program may be implemented at the direction of the site Health Physics Technician. Exit bioassay will be required if on-site monitoring indicates that action levels have been exceeded.

8.3 Air Monitoring

Air monitoring may be required by the Site H&S Officer with either general air monitors or personal air samplers as the situation warrants if the action level of 20 milliroentgens per hour (mR/hr) is exceeded. Respirators shall be required if air monitoring action levels are exceeded.

During initial ground penetration, continuous monitoring with the gamma and beta radiation detectors will be conducted. Thereafter, monitoring will be carried out every half hour. Operations will be discontinued if radiation levels exceed 20 mR/hr. Additionally, three high-volume air samplers will be positioned in the EZ at the hotline in the mean downwind direction during excavation and soil packaging activities. While little or no dusting is anticipated due to high moisture content of the soil, high-volume air samplers will be utilized to monitor fugitive dust. Each high-volume air sampler will collect any fugitive dust emissions from the excavation operations on filter paper. Three 10-cm^2 aliquots will be cut from the filter, counted in the on-site laboratory for alpha and beta/gamma activity, and the results averaged for the three samples. Finally, four pressurized ion chambers (PICs) will be positioned approximately 30 m (100 ft) from the corner points of the EZ. The PICs will be monitored at four hour intervals during operations in the EZ.

Industrial hygiene (IH) chemical monitoring is not anticipated, as no chemical contaminants are expected to be present on the site.

8.4 Action Levels

An overview of radiologic action levels is presented in Table 8-1.

Table 8-1
Radiologic Action Levels

Parameter	Level	Action
Ambient field	1,000 μR/hr	Rope off work area
Air samples resulting from visible dusting or high-volume air samples	8.1×10^{-10} Bq/ml (2.2×10^{-14} μCi/ml)	Full-face air-purifying respirators with HEPA filters
Personnel surface alpha contamination	30 dpm/100 cm^2	Don coveralls, boot covers and gloves
Personnel surface alpha contamination	4,000 dpm/100 cm^2	Perform air sampling
Shipping of samples	< 74 Bq/g (< 2,000 pCi/g)	Ship as nonradioactive

External Radiation

The estimated level of current total activity of the material placed under the mound on the Project Chariot Site is 1.1 becquerel per gram (Bq/g) (30 picocuries per gram [pCi/g]) from Cs-137 (Appendix C). Assuming a uniform distribution of Cesium-137 in this soil, an estimated exposure rate of 19.7 µR/hr or 0.0197 mrem/hr is obtained by calculation and environmental measurements (Helfer and Miller, 1988). One work month or 166 hours of exposure would result in 3.27 mrem exposure. At this exposure rate, maximum exposure in one year would be 41 mrem, which is less than half of the minimum dose (100 millirems per year [mrem/yr]) for which DOE requires external dosimetry (DOE Order 5480.11, Section 9.g.1). In light of these factors, the external radiation monitoring performed on the Project Chariot Site is significantly more protective than the minimum requirements of DOE Orders.

Internal Radiation, Airborne

No significant dusting, which provides a vehicle for internal radiation exposure, is anticipated as the soils to be excavated at the Project Chariot Site contain approximately 30 percent moisture. However, high volume air samplers will be deployed on site to confirm this expectation (see Section 8.2) and filter fabric deployed to arrest any potential fugitive dust emissions.

Action Level: Personal air samplers will be required if visible dusting occurs. Respirators are required if high-volume or personal air samples indicate concentrations in excess of 8.1×10^{-10} becquerels per milliliter (Bq/ml) (2.2×10^{-14} microcuries per milliliter [µCi/ml]).

Internal Radiation, Surface Contamination

Surface contamination limits are dominated by plutonium-239. The soil has a density of about 2.5 g/cm^3 (151 lb/ft^3). A cubic centimeter of soil (0.06 cubic inches of soil) would have 121 disintegrations per minute (dpm) of plutonium-239 alpha at the assumed concentration of 0.81 Bq/g (22 pCi/g), of which less than 10 percent would be seen on any surface of a theoretical cube (natural radioactivity would contribute roughly the same amount of alpha radiation). As the limiting surface value is 300 dpm of alpha per 100 cm^2 per DOE Order 5480.11, it is not expected that the limiting surface value can be reached.

Action Levels: Protective clothing is required if surface contamination exceeds 1/10th the limiting surface value for alpha of 300 dpm/100 cm^2 (i.e., 30 dpm/100 cm^2). Protective clothing will consist of coveralls and gloves. Personnel contamination monitoring will be performed with an alpha scintillation probe. Personal air sampling is required if surface contamination (by swipe test) in excess of 4,000 dpm/100 cm^2 is detected.

Bioassay

Cs-137 is one of the easiest radionuclides to detect by whole body counting, with a detection limit near 110 Bq (3 nanocuries [nCi]). Assuming that the Cs-137 concentration in the soil is about 1 Bq/g (40 pCi/g), a total of 75 g (0.17 lb) of soil would have to be ingested or inhaled to attain the detection limit. Intakes of these magnitudes are most unlikely. Bioassay is not anticipated.

Action Level: No action levels are indicated.

Shipping

Samples containing less than 74 Bq/g (2,000 pCi/g) can be shipped as nonradioactive, according to DOT standards. Other shipping standards are contained in DOT regulations 49 C.F.R. 173.442 and .443.

Action Levels: Any package exhibiting greater than 2 mrem/hr at contact must be repackaged using smaller amounts of contents or more distance from package surface. Any package exhibiting more than 220 dpm removable alpha/100 cm^2 must be cleaned below these levels. Any package exhibiting more than 2,200 dpm removable beta-gamma/100 cm^2 must be cleaned below these levels.

8.5 Noise Monitoring

During the initial phase of operations, the noise exposure of all site personnel will be determined through the use of noise dosimeters and/or a sound-level meter. All noise monitoring equipment will be calibrated against a known sound source, both before and after use. The noise monitoring will be carried out by a H&S professional.

8.6 Safety Review

At least once during the project, the IT Project Manager will carry out a comprehensive on site safety review of the project. The Site Superintendent, accompanied by the Site H&S Officer, will conduct frequent site safety inspections (no less than twice per week). The Site Superintendent will record the inspection results on the Field Activity Daily Log (FADL) and/or appropriate surveillance forms.

8.7 Monitoring Records

The IT Project Manager shall ensure that site monitoring records are complete and incorporated into the project file. Any personnel or area air monitoring results will be incorporated into the health and safety files. The required monitoring information is:

- Employee name, social security number (to remain confidential), payroll number
- The date, time, pertinent task information, exposure information
- Description of the analytical methods, equipment used, and calibration data
- Type of PPE worn
- Engineering controls used to reduce exposure.

8.8 Notification

Within five working days after receipt of monitoring results, the project H&S staff will ensure that each employee is informed in writing of the results that represent the employee's exposure.

Whenever the results indicate that the representative employee exposure exceeds the relevant DOE exposure standard, the employee exposure report shall state the exact DOE standard, which was exceeded and shall provide a description of the corrective action taken to reduce exposure to a level below the standard.

This page intentionally left blank

9.0 Employee Training

All on site project personnel who may be required to perform activities inside the CRZ shall have completed at least 40 hours of hazardous-waste operations-related training, as required by OSHA Regulation 29 C.F.R. 1910.120. All such field employees shall have a minimum of three days of actual field experience under the direct supervision of a trained, experienced supervisor. Those personnel who completed the 40-hour training more than 12 months prior to the anticipated completion of the project shall have completed an 8-hour refresher course within the past 12 months. The Site Superintendent and any site worker in a supervisory capacity shall have completed an additional 8 hours of relevant H&S training and shall have a current first-aid/CPR certificate. Subcontractor personnel must meet the above training requirements.

The presenting organization should provide any employee who completes the required 40 hours of classroom training and eight hours of refresher training with a certificate signed by the instructor. A copy of the certificate is to be maintained in the site files. Subcontractors or others entering the CRZ must provide certificates of training for the project file for all employees assigned to the project.

9.1 Tailgate Safety Meetings

Prior to the start of the project, all personnel will participate in a tailgate safety meeting. During the tailgate safety meeting, the SSHASP will be discussed. The Site Superintendent will ensure that the anticipated site hazards are summarized and explained to all personnel and that those personnel are aware of the precautions they must take to minimize their exposure to those hazards. Additional tailgate safety meetings will be held at the start of each work shift. All site personnel, including visitors, must attend each Tailgate Safety Meeting and sign the Tailgate Safety form. Tailgate Safety forms are maintained with the project files.

9.2 Material Safety Data Sheets

The SSHASP includes Material Safety Data Sheets (MSDS) and occupational health guidelines for chemical substances known to be on site (Attachment A). The SSHASP is maintained on site and is accessible to all site employees. Each employee is required to review and sign the SSHASP before starting work on the site.

9.3 Site-Specific Health and Safety Plan

IT has prepared this SSHASP within the scope and application of 29 C.F.R. 1910.120. The Site Superintendent will present the SSHASP and discuss it with all personnel assigned to the project. All workers must read and sign the SSHASP, acknowledging acceptance of site rules and understanding of site hazards before the start of site work.

9.4 Site Workers' Basic Course

The following is a list of the topics covered in a typical 40-hour training course:

- General site safety
- Physical hazards (e.g., fall protection, noise, heat stress, cold stress)
- Safety, health, and other hazards typically present at hazardous waste sites
- Use of PPE
- Work practices by which employees can minimize risks from hazards
- Safe use of engineering controls and equipment on site
- Medical surveillance requirements, including recognition of symptoms and signs that might indicate overexposure to hazards
- Worker right-to-know (Hazard Communication OSHA 1910.1200)
- Routes of exposure to contaminants
- Engineering controls and safe work practices
- Components of a typical Site H&S program
- Decontamination practices for personnel and equipment
- Confined-space entry procedures
- Emergency response plan.

9.5 Supervisors' Course

Management and supervisors receive an additional eight hours of training which includes:

- General site safety and health programs
- PPE programs
- Air monitoring techniques.

9.6 Site-Specific Training

Site-specific training will be accomplished through a review of this SSHASP and the daily tailgate safety meetings. No expected conditions approach levels that would classify employees as radiation workers. Employees will be informed of the hazard analysis. Note that action levels (Section 8.4) developed are for exception circumstances that are highly unlikely to occur.

9.7 First Aid and Cardiopulmonary Resuscitation

At least two employees currently certified by the American Red Cross in First Aid/Adult CPR will be assigned to the work crew and will be on the site whenever operations are ongoing. Annual refresher training in first aid and CPR is required to maintain the currency of the certificate.

9.8 Instructors

Trainers shall be qualified to instruct employees about the subject matter that is being presented in training. Such trainers shall have satisfactorily completed a training program for teaching the subjects they are expected to teach, or they shall have the academic credentials and instructional experience necessary for teaching the subjects. Instructors shall demonstrate competent instructional skills and knowledge of the applicable subject matter.

This page intentionally left blank

10.0 Medical Surveillance

10.1 Medical Examination

All on site project personnel who may be required to perform activities inside the CRZ shall have completed a comprehensive medical examination within the past 12 months that meets the requirements of OSHA Regulation 29 C.F.R. 1910.120. The annual medical typically includes the following elements:

- Medical and occupational history questionnaire
- Physical examination
- Complete blood count, with differential
- Liver function tests
- Chest X-ray, once every three years following a baseline assessment X-ray
- Pulmonary function test
- Audiogram
- Electrocardiogram for persons older than 45 years of age, or if indicated during the physical examination
- Drug screening
- Visual acuity
- Follow-up examinations, at the discretion of the examining physician or the corporate medical director.

The examining physician must provide the employee with a letter summarizing his findings and recommendations. Employees also have the right to inspect and obtain a copy of their medical records.

The examining physician must provide the employer with a letter confirming the worker's fitness for work and ability to wear a respirator. A copy of this letter for all project workers will be kept on site during all project site work.

Subcontractors will certify that all their employees have successfully completed a physical examination by a qualified physician on the Certification Form (Attachment B). The physical examinations shall meet the requirements of 29 C.F.R. 1910.120 and 29 C.F.R. 1910.134. Subcontractors will supply copies of the medical examination certificate, signed by a physician and stating the examination was performed, and clearance was granted, in compliance with 29 C.F.R. 1910.120 requirements for each on-site employee.

10.1.1 Placement Examination

All employees will receive a pre-placement medical examination prior to assignment to field operations, in compliance with 29 C.F.R. 1910.120 (f)(3)(i)(A).

10.1.2 Annual Examination

Each year, subsequent to the placement examination, all employees and subcontractors must undergo an annual examination, similar in scope to the placement examination. The medical and occupational history is updated with each examination.

10.1.3 Exit Examination

Site employees shall receive a medical examination upon termination of employment with their respective employers.

10.2 First-Aid and Medical Treatment

All persons on site must report any near-miss incident, accident, injury, or illness to their immediate supervisor or the Site Superintendent. First aid will be provided by a qualified Paramedic or Emergency Medical Technician (EMT) stationed on site. In the event of an accident, the employee's supervisor or the Site Superintendent will complete the "Supervisor's Employee Injury Report" and conduct an accident investigation as soon as emergency conditions no longer exist and first-aid and/or medical treatment has been ensured. The investigation should follow the Accident/Injury Investigation Report (Attachment C). These two reports must be completed and submitted to the Program H&S Manager (Site H&S Officer for this site) within 24 hours after the incident.

If first-aid treatment is required, first aid kits are kept at the CRZ and in several support structures. If treatment beyond first aid is required, medical evacuation will be provided to Kotzebue; therefore, an emergency hospital route map is not provided.

10.3 Medical Restriction

When a medical care provider (e.g., physician, nurse, or on site EMT) identifies a need to restrict work activity, the employee's restriction shall be communicated to the employee, their supervisor, and the Site H&S Officer. The terms of the restriction will be discussed with the employee and the supervisor. Every attempt will be made to keep the employee working, while not violating the terms of the medical restriction.

10.4 Medical Records

Medical and personal-exposure monitoring records will be maintained according to the requirements of 29 C.F.R. 1910.20 and relevant DOE Orders. Employee confidentiality shall be maintained.

11.0 Emergency Procedures

This SSHASP has been developed to allow site operations to be conducted without adverse impact to the safety or health of project personnel, other personnel, and the environment. Supplementary procedures are included in this section to address extraordinary conditions that might occur at the site.

11.1 General

The Site H&S Officer will establish evacuation routes and assembly areas for each site of operations. All personnel entering the site will be informed of these routes and assembly areas.

Each site will be evaluated for the potential for fire, explosion, chemical release, or other catastrophic events. Unusual events, activities, chemicals, and conditions will be reported to the Site Superintendent.

Emergency survival equipment will be staged at the site and aboard all aircraft used to transport personnel and will provide sufficient food and supplies for a minimum of three days for each person on site or in the aircraft. These supplies are not to be used for any purpose but emergency survival. The Site Superintendent will verify the integrity and contents of each survival cache at least weekly, and document the inspection in the field logbook.

11.2 Emergency Actions

If an incident occurs, the Site Superintendent will:

- Evaluate the incident and assess the need for assistance
- Call for outside assistance as needed
- Ensure the IT and DOE Project Managers, and the Site H&S Officer are notified promptly of the incident
- Take appropriate measures to stabilize the incident scene.

11.3 Safety Signals

Vehicle or portable air horns or whistles will be used for safety signals as follows:

- One long blast: Emergency evacuation of the site
- Two short blasts: Clear working area around powered or moving equipment.

11.4 Medical Emergency

All employee injuries must be promptly reported to the Site Superintendent. The Site Superintendent will:

- Ensure that the injured employee receives prompt first aid and medical attention
- Ensure that the DOE and IT Project Manager and Site H&S Officer are promptly notified of the incident
- Initiate an investigation of the incident.

11.4.1 Personal Injury Accident

In the event of a personal injury accident, the Site Superintendent will assess the nature and seriousness of the injury. In the case of serious or life-threatening injuries, normal decontamination procedures may be ignored. Less serious injuries, such as strains, sprains, minor cuts, and contusions, may be treated only after the employee has been decontaminated.

Following decontamination, the Paramedic or EMT, or a project team member qualified in first aid and CPR, will administer suitable first aid. The Site H&S Officer will, if necessary, arrange transport to the appropriate medical facility.

11.5 Fire

In the case of a fire on the site, the Site Superintendent will assess the situation and direct fire-fighting activities. The Site Superintendent will ensure that the DOE/ER representative is immediately notified of any fires. Site personnel will attempt to extinguish the fire with available extinguishers, if it is safe to do so.

11.6 Emergency Information

11.6.1 Public Agencies

U.S. DOE/ER Division (Kevin Cabble)	(702) 295-5000
Alaska Department of Environmental Conservation (Douglas Dasher)	(907) 451-2172
U.S. Fish and Wildlife Service (John Martin)	(907) 235-6546
Department of Natural Resources (Stoney Wright)	(907) 745-4469

11.6.2 Key Project and IT Personnel

IT Project Manager (Andrea M. Hopkins, CHMM, CEM)	(702) 295-4699
IT H&S Manager (Brian G. Klenk, CIH, CEM)	(702) 295-1613
IT Program Manager (Joseph G.Yeasted, PhD, PE)	(702) 295-5543

This page intentionally left blank

ATTACHMENT A

MATERIAL SAFETY DATA SHEETS

This page intentionally left blank

Formaldehyde
(CAS NUMBER: 50-00-0)

SYNONYMS

Formic aldehyde/Methyl aldehyde/Methanal/Methylene oxide/Oxomethane/Oxymethylene/Paraform/Aldehyde formique (French)/Aldeide formica (Italian)/FA/Formaldehyd (Czech,Polish)/Formalina (Italian)/Formaline (German)/Opolssingen (Dutch)

TRADE NAMES

Lysoform; Formalin 40; Fannoform; Morbicid; Ivalon; Formalin; Formalith; Formol; Fyde.

DESCRIPTION OF SUBSTANCE

Formaldehyde is a readily polymerizable, colorless gas with a suffocating odor. Formaldehyde is commonly employed as formalin, a 37 to 50 percent aqueous solution, ordinarily containing methanol as a polymerization inhibitor. [ACGIH, P. 276, 1986]

HEALTH EFFECTS

Formaldehyde is a known animal carcinogen and has produced tumors of the nasal cavity in animals; it is considered a potential human carcinogen by OSHA, NIOSH, ACGIH, IARC, and NTP. Formaldehyde gas is an irritant of the eyes and respiratory tract; solutions cause both primary irritation and sensitization dermatitis. [PROCTOR & HUGHES, P. 273, 1978]
If solution is ingested, mucous membranes of mouth, throat, and intestinal tract are irritated, and severe pain, vomiting, and diarrhea result. After absorption, formaldehyde depresses CNS and symptoms not unlike those of alcohol intoxication are noted. They consist of vertigo, depression, and coma. Rarely, convulsions are observed. [GOODMAN. PHARM BASIS THERAP 5TH ED 1975]
Alteration of tissue proteins by formaldehyde causes local toxicity and promotes allergic reactions. Repeated contact with solution may cause eczematoid dermatitis. Dermatitis from clothing treated with formaldehyde has occurred. [GOODMAN. PHARM BASIS THERAP 6TH ED 1980]
Aqueous solutions splashed or dropped on human eyes have caused injuries ranging from severe permanent corneal opacification and loss of vision to minor transient injury or discomfort, depending upon whether solutions were of high or low concentration. [TOX OF THE EYE 1974]
Inhalation of a high concentration caused severe irritation of respiratory tract, leading in two instances to death. Pulmonary edema, with residual cardiac impairment in one case, was reportedly caused by single acute inhalations. [ACGIH. TLVS. 4TH ED & SUPPL. 1980]
In sensitized subjects specific late asthmatic reactions may be

provoked by brief exposures at approximately 3 ppm. [HENDRICK DJ ET AL; FORMALDEHYDE ASTHMA: CHALLENGE EXPOSURE LEVELS AND FATE AFTER 5 YEARS J OCCUP MED 24(11) 893 (1982)]
Ingestion of formaldehyde can cause a reduction in body temperature. [ENVIRONMENT CANADA; TECH INFO FOR PROBLEM SPILLS: FORMALDEHYDE (DRAFT) P.90 (1982)]
Symptoms related to ingestion of formaldehyde include: jaundice, acidosis, and hematuria. Symptoms related to inhalation include: rhinitis, anosmia, laryngospasm, tracheitis, and gastroenteritis. [ITII. TOX & HAZARD INDUS CHEM SAFETY MANUAL 1982]
In a survey of 57 embalmers who were exposed to atmospheric concentration below 2 ppm, there was a high incidence of symptoms of irritant effects on the eyes (81%) and nose and throat (75%). Other respiratory effects included cough (33%), chest tightness (23%), wheezing (12%), and shortness of breath (11%). On the basis of the results, 10% were acute bronchitics, and 30% were chronic bronchitics. No control group was used and cigarette smoking was not taken into account. [PLUNKETT ER, BARBELA T; AM IND HYG ASSOC J 38: 61 (1977)]
Eyes: concentrations of 1-10 ppm may produce appreciable eye irritation on initial exposure; lacrimation occurs at about 4 ppm. [HEALTH AND SAFETY EXECUTIVE MONOGRAPH: FORMALDEHYDE P.8 (1981)]
Cultured bronchial and fibroblastic cells from humans were used to study DNA damage and toxicity. Formation of crosslinks between DNA and proteins caused single-strand breaks in DNA, and inhibited reseal of single-strand breaks produced by ionizing radiation. [GRAFSTROM RC ET AL; FORMALDEHYDE DAMAGE TO DNA AND INHIBITION OF DNA REPAIR IN HUMAN BRONCHIAL CELLS; SCIENCE (WASHINGTON, DC, 1883-) 220(4593) 216 (1983)]
Formaldehyde induced a 1.5-3 fold increase in sister chromatid exchanges in human lymphocytes in culture. [OBE G, BEEK B; DRUG AND ALCOHOL DEPENDENCE 4: 91-94 (1979)]
Formaldehyde was mutagenic for diploid human lymphoblasts in culture inducing an increased number of mutations at 130 um/M or 4 ppm by weight. [GOLDMACHER VS ET AL; TOXICOL EPIDEMIOL MECH (PAP MEET) 2ND, P.173-191 (1983)]
Outbreak of hemolytic anemia attributed to accidental exposure occurred among patients on hemodialysis. A 41-year-old woman died 28 hours after ingesting 120 ml of solution (37% wt vol formaldehyde, 12.5% wt vol methanol, containing no formic acid). [IARC MONOGRAPHS. 1972-PRESENT]
Effects in women attributed to exposure include menstrual disorders and secondary sterility. [IARC MONOGRAPHS. 1972-PRESENT]

TOXICITY/EXPOSURE LIMITS

		(Gas)	(Liquid)
NFPA RATING	Flammability	4 Extreme	2 Moderate
	Health	2 Moderate	2 Moderate
	Reactivity	0 None	0 None

TOXICITY HAZARD RATING - Acute and chronic local: skin 3; mucous membranes 3; eyes 3; Acute and chronic systemic: ingestion 3; inhalation 3; skin 3. 3 = High: may cause death or permanent injury after exposure to small quantities. [SAX. DANGER PROPS INDUS MATER 6TH ED, P. 1451, 1984] 3. 3= Moderately toxic: probable oral lethal dose (human) 0.5-5 g/kg, between 1 ounce and 1 pint (or 1 lb) for 70 kg person (150 lbs). [GOSSELIN. CTCP 4TH ED, P. II-187, 1984]

IMMEDIATELY DANGEROUS TO LIFE OR HEALTH - None - Potential human carcinogen. [NIOSH POCKET GUIDE TO CHEM HAZARDS P. 128 8 (1985) DHEW (NIOSH) PUB NO. 85-114]

OSHA PEL - 1.000 ppm, ******* mg/m3;TWA
2.000 ppm, ******* mg/m3;STEL
See 1910.1048 and table Z-2 for operations or sectors excluded or for which limits are stayed.

ADOPTED ACGIH/TLV - 1.000 ppm, 1.500 mg/m3;TWA - (A2) Suspected human carcinogen
2.000 ppm, 3.000 mg/m3;STEL

NIOSH/REL - 0.016 ppm, ***** mg/m3;TWA - Potential occupational carcinogen
0.100 ppm, ***** mg/m3;STEL - 15 minutes

INDUSTRY USE DATA

disinfecting dwellings, ships, storage houses, uteFormaldehyde is used in nsils, clothes; germicide and fungicide for plants and vegetables; destroying flies and other insects; manufacture phenolic resins, artificial silk and cellulose esters, dyes, organic chemicals, glass mirrors, explosives; improving fastness of dyes on fabrics; mordanting and waterproofing fabrics; preserving and coating rubber latex; in photography for hardening gelatin plates and papers; toning gelatin-chloride papers; chrome printing and developing; to render casein, albumin and gelatin insoluble; in chemical analysis; to prevent mildew and spelt in wheat and rot in oats; fumigant. [MERCK INDEX 9TH ED 1976]
Fixation of histological specimens and in alteration of bacterial toxins to toxoids for vaccines solution, USP. [GOODMAN. PHARM BASIS THERAP 5TH ED 1975]
As germicide mainly used in 2-8% concentration to disinfect inanimate objects. [GOODMAN. PHARM BASIS THERAP 6TH ED 1980]

Formaldehyde has been used in studies of isotope separation. [KIRK-OTHMER. ENCYC CHEM TECH 3RD ED 1978-PRESENT]
Important uses include wood-industry products, molding compound, foundry resins, adhesives for insulation, slow-release fertilizers, the manufacture of permanant-press finishes of cellulose fabrics, and formaldehyde-based textile finishes. [KIRK-OTHMER. ENCYC CHEM TECH 3RD ED 1978-PRESENT]
In manufacturing fatty amides and in precious metal recovery. [ENVIRONMENT CANADA; TECH INFO FOR PROBLEM SPILLS: FORMALDEHYDE (DRAFT) P.13 (1982)]
Chemical intermediate for urea-formaldehyde resins and concentrates. Chemical intermediate for phenolic, polyacetal and melamine resins. Chemical intermediate for acetylenic chemicals - especially, 1,4-butanediol. Chemical intermediate for polyols-e.g., pentaerythritol. Chemical intermediate for hexamethylenetetramine. Chemical intermediate for methylene dianiline (precursor of MDI). Chemical intermediate for chelating agents. Agent in treatment of textiles (formaldehyde and derivatives). Chemical intermediate for pyridine chemicals and nitroparaffin derivatives. Disinfectant and deodorant. Component of dyes and drilling muds; starch preservatives. Embalming agent. Chemical intermediate for resorcinol-formaldehyde resins. Chemical intermediate for aniline-formaldehyde resins. Chemical intermediate for rubber-processing chemicals. Sewage treatment agent. Component of photographic developers. Chemical intermediate for synthetic tanning agents. Component of trioxane fuel tablets. Preservative-e.g., of ensiloed forage. Chemical intermediate for herbicides and fertilizer coatings. Chemical intermediate for pharmaceuticals and elastomeric sealants. [SRI]
Melamine-formaldehyde resins may be formulated (as cymel) for use as molding powders, laminates, adhesives and for treatment of textiles. Molding powders and laminates most familiar as dinnerware (melmac) and laminates (formica). Dinnerware represents largest single use. Melamine-formaldehyde resins permitted in food-contact applications such as coatings, components of packaging and molded articles. [PATTY. INDUS HYG and TOX 3RD ED VOL2A,2B,2 1981-82]

NIOSH 1982 NATIONAL OCCUPATIONAL EXPOSURE SURVEY

SIC CODE	INDUSTRY NAME	TOTAL ON PAYROLL	TOTAL EXPOSED	PERCENT EXPOSED
3339	PRIMARY NONFERROUS METALS, NEC	160	65	40.63
4783	PACKING AND CRATING	79	31	39.24
2891	ADHESIVES AND SEALANTS	832	263	31.61
2833	MEDICINALS AND BOTANICALS	2,347	611	26.03
8071	MEDICAL LABORATORIES	1,021	194	19.00
2992	LUBRICATING OILS AND GREASES	546	84	15.38
0742	VET. SERVICES, SPECIALTIES	129	19	14.73
2327	MENS'/BOYS' SEPARATE TROUSERS	3,782	493	13.04
2824	ORGANIC FIBERS, NONCELLULOSIC	12,408	1,328	10.70

2841	SOAP AND OTHER DETERGENTS	1,437	128	8.91
2822	SYNTHETIC RUBBER	488	28	5.74
7397	COMMERCIAL TEST LABS	1,359	75	5.52

NIOSH 1972 NATIONAL OCCUPATIONAL HAZARD SURVEY

SIC CODE	INDUSTRY NAME	TOTAL ON PAYROLL	TOTAL EXPOSED	PERCENT EXPOSED
2521	WOOD OFFICE FURNITURE	45	30	66.67
2352	HATS AND CAPS, EXCEPT MILLINE	201	94	46.77
2843	SURFACE ACTIVE AGENTS	339	133	39.23
7512	PASSENGER CAR RENTAL AND LEAS	120	39	32.50
3299	NONMETALLIC MINERAL PRODUCTS	496	150	30.24
3562	BALL AND ROLLER BEARINGS	560	163	29.11
7395	PHOTOFINISHING LABORATORIES	22	6	27.27
7261	FUNERAL SERVICE AND CREMATORI	284	75	26.41
3496	COLLAPSIBLE TUBES	766	159	20.76
2891	ADHESIVES AND GELATIN	50	9	18.00
2851	PAINTS AND ALLIED PRODUCTS	2,299	365	15.88
1752	FLOOR LAYING AND FLOOR WORK	188	27	14.36
7531	TOP AND BODY REPAIR SHOPS	43	6	13.95
7231	BEAUTY SHOPS	126	16	12.70
8071	MEDICAL LABORATORIES	222	26	11.71
2643	BAGS, EXCEPT TEXTILE BAGS	920	85	9.24
6724	UNIT INVESTMENT TRUSTS	142	13	9.15
2329	MEN'S AND BOYS' CLOTHING, NEC	2,462	219	8.90
2631	PAPERBOARD MILLS	1,035	87	8.41
2818	INDUSTRIAL ORGANIC CHEMICALS	1,362	108	7.93
2295	COATED FABRICS, NOT RUBBERIZE	1,244	98	7.88
2753	ENGRAVING AND PLATE PRINTING	43	3	6.98
2262	FINISHING PLANTS, SYNTHETICS	936	59	6.30
2256	KNIT FABRIC MILLS	4,110	256	6.23
3021	RUBBER FOOTWEAR	1,080	65	6.02
4931	ELECTRIC AND OTHER SERVICES C	681	39	5.73
2791	TYPESETTING	201	11	5.47
2432	VENEER AND PLYWOOD	827	44	5.32
6122	FEDERAL SAVINGS & LOANS ASSOC	78	4	5.13

OSHA/EXPOSURE DATA

NONE

ENGINEERING CONTROLS

General ventilation; local exhaust ventilation; hood; enclosure of process or worker. These are methods for reduction of formaldehyde vapor/paraformaldehyde dust in dioxalane operation. Company operation was chemical manufacturing; large supra-sacks (2000 lbs.) were substituted for 100 lb. bags. Double sack construction allows for positioning of inner and outer sacks, reducing exposure. Feeder line was improved. Ventilation system installed with a glycol bath system to capture generated vapors.

Level reduction 199 ppm to 0.15 ppm. [HAZARD ABATEMENT FILE]

PERSONAL PROTECTIVE EQUIPMENT

A totally encapsulated chemical suit, and gas-tight safety goggles should be worn. [NIH/EPA; OHM/TADS (1984)]
A full face-piece is recommended for all levels of exposures above the TLV or where splashing is probable. [GENERAL ELECTRIC CO; MATERIAL SAFETY DATA SHEET #360 (1981)]
Laboratory protective equipment: goggles and shield; lab coat and apron; vent hood; proper gloves; class B extinguisher. Eye/skin protection: protective suit, proper gloves are recommended. Respiratory protection should be as follows: any self-contained breathing apparatus with full facepiece and operated in a pressure-demand or other positive pressure mode or any supplied-air respirator with a full facepiece and operated in pressure-demand or other positive pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive pressure mode. Escape: any air-purifying full facepiece respirator (gas mask) with a chin-style or front- or back-mounted canister providing protection against the compound of concern or any appropriate escape-type self-contained breathing apparatus.

STORAGE

Storage color code: red (flammable). Special precautions: Keep container tightly closed. Store in a cool, dry, well-ventilated, flammable liquids storage area or cabinet. Store above 15 C. General storage procedure: protect against physical damage. Separate from oxidizing and alkaline materials. Indoor storage should be in areas having floors pitched toward a trapped drain or in curbed retention areas. Minimum storage temperatures to prevent polymerization range from 83 degrees Fahrenheit for 37% formaldehyde containing .05% methyl alcohol to 29 degrees Fahrenheit for formaldehyde containing 15% methyl alcohol.

INDUSTRY USE DATA

This material is used as a selective fluorinating agent. [MERCK 1983, P. 1289]
It is also used as a pesticide intermediate. [SITTIG, P. 819, 1985]

NIOSH 1982 NATIONAL OCCUPATIONAL EXPOSURE SURVEY

NONE

NIOSH 1972 NATIONAL OCCUPATIONAL HAZARD SURVEY

NONE

OSHA/EXPOSURE DATA

NONE

ENGINEERING CONTROLS

General ventilation; local exhaust ventilation; hood; enclosure of process or worker.

PERSONAL PROTECTIVE EQUIPMENT

By analogy with phosgene, sulfur tetrafluoride handling requires the following respiratory protection: Up to 1 ppm: Supplied air respirator or self-contained breathing apparatus. Substance reported to cause eye irritation or damage; may require eye protection. Up to 2 ppm: any self-contained breathing apparatus with a full facepiece or any supplied-air respirator with a full facepiece. Emergency or planned entry in unknown concentration or IDLH conditions: any self-contained breathing apparatus with full facepiece and operated in a pressure-demand or other positive pressure mode or any supplied-air respirator with a full facepiece and operated in pressure-demand or other positive pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive pressure mode. Escape: any air-purifying full facepiece respirator (gas mask) with a chin-style or front- or back-mounted canister providing protection against the compound of concern or any appropriate escape-type self-contained breathing apparatus. [NIOSH: POCKET GUIDE TO CHEMICAL HAZARDS P. 193 (1987) DHEW (NIOSH) PUB NO. 85-114]

STORAGE

NONE

Sulfuric acid
(CAS NUMBER: 7664-93-9)

SYNONYMS

Dihydrogen sulfate/Dipping acid/Oil of vitriol/Sulphuric acid/ Vitriol brown oil/Acide sulfurique (French)/Acido solforico (Italian)/Hydrogen sulfate /Matting acid /Nordhausen acid /Schwefelsaeureloesungen (German) /Zwavelzuuroplossingen (Dutch)/ Spirit of sulfur

TRADE NAMES

NONE

DESCRIPTION OF SUBSTANCE

Sulfuric acid is a colorless, oily liquid. The pure anhydrous acid decomposes into sulfur trioxide and water at 340 degrees C. It is soluble in water and alcohol with release of heat. Since its vapor pressure is negligible, it exists in the air only as mist or spray. [ACGIH, P. 544, 1987]
Spent sulfuric acid is a black oily liquid. It is soluble in water with release of heat.

HEALTH EFFECTS

Sulfuric acid is corrosive to all body tissues. Inhalation of vapor may cause serious lung damage. Contact with eyes may result in total loss of vision. Skin contact may produce severe necrosis. Fatal amount for adult: between 1 teaspoonful and one-half ounce of the concentrated chemical. Even a few drops may be fatal if the acid gains access to the trachea. Chronic exposure may cause tracheobronchitis, stomatitis, conjunctivitis, and gastritis. Gastric perforation and peritonitis may occur and may be followed by circulatory collapse. Circulatory shock is often the immediate cause of death. Signs and symptoms of exposure: contact causes corrosion of mucous membranes of mouth, throat, and esophagus with immediate pain and difficulty in swallowing. Damaged tissue is greyish white, soon to be black, shrunken and wrinkled. Epigastric pain, nausea and vomiting, and gastric hemorrage also result. Vomit may contain fresh blood and victims complain of profound thirst. Clammy skin, weak and rapid pulse, shallow respiration and scanty urine are caused by exposure. Medical conditions generally aggravated by exposure: those with chronic respiratory, gastrointestinal, or nervous diseases and any eye and skin diseases are at greater risk. [EPA, 1986]
Sulfuric acid attacks enamel of teeth. [PATTY. INDUS HYG & TOX 2ND ED VOL2 1963]
Healthy male volunteers were exposed by mask to 10 N acid mist concentration ranging from 3 to 39 mg/m3 (1 um median diameter) at 62% relative humidity. The subjects were also exposed in

chamber to 4N acid mist of from 11.5 to 38 mg/m3 (1.5 um median diameter) at 91% relative humidity. Mask exposures were of 10 minutes' duration and chamber exposures were up to 60 minutes in duration. In general, the sulfuric acid was much more irritating at higher humidity. The irritant effect of 20.8 mg sulfuric acid per m3 at high humidity (and large particle size) was greater than that of 39.4 mg sulfuric acid per cubic meter at lower humidity (and smaller particle size). Under the conditions of high humidity, increases in airway resistance of from 43 to 150% above preexposure levels were measured and increases under the lower humidity conditions (62%) ranged from 35.5 to 100%. [SIM VM AND PATTLE RE; JAMA 165: 1908-1913 (1971) AS CITED IN NIOSH; CRITERIA DOCUMENT: SULFURIC ACID P.28 (1974) DHEW PUB. NIOSH 74-128]

Ten human subjects were exposed to low concentrations of sulfuric acid aerosol to determine the subjective threshold for irritation and other low-level effects. The mean minimum concentration was 0.72 mg/m3 (0.6 to 0.85 mg/m3) to which the 10 subjects averaging 33 tests per subject, detected minimal effects of throat tickling and scratching. At 1.1 to 21.1 mg/m3, all subjects noticed considerable irritation at the base of the esophagus and 40% of the subjects noticed irritation of the eyes. At 2.4 to 6.0 mg/m3, all subjects experienced acute irritation of the mucous membranes and a pronounced reflex cough. All individuals experienced eye irritation at this exposure level. Pneumographic studies were performed on three of the subjects exposed to 0.6 to 2.0 mg/m3. No respiratory changes were elicited by exposures to less than 1.0 mg/m3. Slight changes in respiration occurred at levels of 1.0 to 1.1 mg/m3, and concentrations of 1.8 to 2.0 mg/m3 produced changes in respiratory amplitude anUSHTUEVA KA; LIMITS OF ALLOWABLE CONCN OF ATMOSPHEd rhythm in all subjects. The particle size of the mists and the ambient humidity were not given. [BRIC POLLUTANTS, BK 3. P.22-36 (1957) AS CITED IN NIOSH; CRITERIA DOCUMENT: SULFURIC ACID P.29 (1974) DHEW PUB. NIOSH 74-128]

Ten patients with sulfuric acid ingestion were studied. The extent and severity of upper gastrointestinal tract injury was determined by fiberoptic endoscopy and necropsy. All patients had esophageal and gastric involvement but the duodenum was spared in the majority. Complications and mortality occurred in patients with severe injury. [DILAWARI JB ET AL; CORROSIVE ACID INGESTION IN MAN - A CLINICAL AND ENDOSCOPIC STUDY; GUT 25 (2): 183-7 (1984)]

Two hundred and twenty-five workers in five lead acid battery plants were administered a questionna underwent spirometry, ire containing questions on work-related symptoms, and had personal samples for sulfuric acid taken over the shift. Most personal samples were less than 1 mg/m3 sulfuric acid. Mass median aerodynamic diameter of sulfuric acid from area samples in the formation areas was 2.6-10 micron. In acclimated workers, there is no evidence of acute symptoms or reductions in pulmonary function over the shift at concentration less than 1 mg/m3. [GAMBLE J ET AL; EPIDEMIOLOGICAL-ENVIRONMENTAL STUDY OF LEAD ACID BATTERY WORKERS. II. ACUTE EFFECTS OF SULFURIC ACID ON THE RESPIRATORY SYSTEM; ENVIRON RESS 35 (1): 11-29 (1984)]

The effects of long-term exposure to sulfuric acid mist on the teeth and respiratory system were studied in 248 workers in five plants manufacturing lead acid batteries. The prevalences of cough, phlegm, dyspnea, and wheezing as determined by questionnaire were not associated with estimates of cumulative acid exposure. There was only one case of irregular opacities seen on the chest radiographs. The ratio of observed to expected prevalence of teeth etching and erosion was about four times greater in the high acid-exposure group. The earliest case of etching occurred after 4 months' exposure to an estimated average exposure of 0.23 mg/m3 sulfuric acid. [GAMBLE J ETAL; EPIDEMIOLOGICAL-ENVIRONMENTAL STUDY OF LEAD ACID BATTERY WORKERS. III. CHRONIC EFFECTS OF SULFURIC ACID ON THE RESPIRATORY SYSTEM AND TEETH; ENVIRON RES 35 (1): 30-52 (1984)]
To determine the extent that submicrometer sulfuric acid aerosol affects clearance from the more distal ciliated airways, the clearance of a monodisperse 4.2-mum MMAD ferric oxide aerosol in 8 healthy nonsmoking subjects was investigated. A greater fraction of the 4.2-mum particles deposited in distal conductive airways. Bronchial mucociliary clearance was slower following 1 hour nasal sulfuric acid inhalations at 100, 300, and 1000 mug per m3 than after sham exposures, while mucociliary transport rates within the trachea and indexes of respiratory mechanics were unchanged. A comparison of the effects of 1 hour exposures at 100 mug per m3 on the clearance of 7.6- and 4.2-mum particles suggests a greater physiological response in distal ciliated airways than in larger central airways. [LEIKAUF GD ET AL; DOSE-DEPENDENT EFFECTS OF SUBMICROMETER SULFURIC ACID AEROSOL ON PARTICLE CLEARANCE FROM CILIATED HUMAN LUNG AIRWAYS; AM IND HYG ASSOC J 45 (5): 285-92 (1984)]

TOXICITY/EXPOSURE LIMITS

NFPA RATING -	Flammability	- 0	None
	Health	- 3	Severe
	Reactivity	- 2	Moderate

TOXICITY HAZARD RATING - Acute and chronic local: skin 3-2; mucous membranes 3-2; eyes 3-2. Acute and chronic systemic: ingestion 3-2; inhalation 3-2; skin 3-2. 3= High: may cause death or permanent injury after exposure to small quantities. 2= Moderate: may involve both irreversible and reversible changes not severe enough to cause death or permanent injury. [SAX. DANGER PROPS INDUS MATER 6TH ED, P. 2487, 1984]

IMMEDIATELY DANGEROUS TO LIFE OR HEALTH - 80 mg/m3 [NIOSH; POCKET GUIDE TO CHEMICAL HAZARDS P.170 (1981) DHEW (NIOSH) PUB NO. 78-210]

OSHA PEL - ******* ppm, 1.000 mg/m3;TWA

ADOPTED ACGIH/TLV - ****** ppm, 1.000 mg/m3;TWA

NIOSH/REL - ****** ppm, 1.000 mg/m3;TWA

INDUSTRY USE DATA

Manufacture of dyestuffs, other acids, parchment paper, glue, purification of petroleum; medication; dilute acid in gastric hypoacidity, formerly as topical caustic. [MERCK INDEX. 10TH ED 1983]
Used in electroplating baths, nonferrous metallurgy; in the production of pigments, rayon, and film; as a laboratory reagent and etchant. [HAWLEY. CONDENSED CHEM DICTNRY 10TH ED 1981]
General-purpose food additive. [FURIA. HDBK FOOD ADD 2ND ED 1972]
Herbicide. [SPENCER. GUIDE TO CHEM IN CROP PROTECT 1982]
As dehydrating agent in manufacture of ethers and esters, gas drying, obtaining glucose by hydrolysis of cellulose; refining of mineral and vegetable oils; in the leather industry; in carbonization of wool fabrics; preparation of bromine and iodine, extraction of uranium from pitchblende. [ENCYC OCCUPAT HEALTH & SAFETY 1983]
Chemical intermediate for fertilizers, aluminum sulfate, ammonium sulfate, surface-active agents and in other applications; agent in production of alcohols, titanium dioxide, explosives and other nitrations, cellulosics, hydrogen fluoride, in iron and steel pickling. [SRI]
In storage batteries. [ACGIH. TLVS. 4TH ED & SUPPL. 1980]
Sulfuric acid in water can be used as an electrolytic solution in a single electrochemical cell. [KIRK-OTHMER. ENCYC CHEM TECH 3RD ED 1978-PRESENT]
Vapor is used as a dopant in exposure of free-standing polyacetylene films. [KIRK-OTHMER. ENCYC CHEM TECH 3RD ED 1978-PRESENT]
Alkylation catalysts. [ITI. TOX & HAZARD INDUS CHEM SAFETY MANUAL 1982]
Solutions are used as selective sprays for onion and garlic crops, especially on Pacific coast. No longer, however, acceptable on onions. Has been used to kill potato tops as harvest aid. [FARM CHEM HDBK. 1984]

NIOSH 1982 NATIONAL OCCUPATIONAL EXPOSURE SURVEY

SIC CODE	INDUSTRY NAME	TOTAL ON PAYROLL	TOTAL EXPOSED	PERCENT EXPOSED
3463	NONFERROUS FORGINGS	26	24	92.31
2833	MEDICINALS AND BOTANICALS	2,347	1,078	45.93
2891	ADHESIVES AND SEALANTS	832	340	40.87
2841	SOAP AND OTHER DETERGENTS	1,437	524	36.46

2873	NITROGENOUS FERTILIZERS	103	29	28.16
3471	PLATING AND POLISHING	1,512	396	26.19
3629	ELECTRIC/INDUSTR. APPAR./NEC	96	20	20.83
2492	PARTICLEBOARD	77	15	19.48
8071	MEDICAL LABORATORIES	1,021	198	19.39
2874	PHOSPHATIC FERTILIZERS	330	60	18.18
2911	PETROLEUM REFINING	10,713	1,899	17.73
7397	COMMERCIAL TEST LABS	1,359	230	16.92
3825	INSTR. TO MEASURE ELECTRICITY	18,445	3,002	16.28
2992	LUBRICATING OILS AND GREASES	546	84	15.38
2812	ALKALIES AND CHLORINE	983	132	13.43
3613	SWITCHGEAR/SWITCHBD APPARATUS	443	56	12.64
4521	NONCERTIFICATED AIR TRANSPRT.	16	2	12.50
3341	SECONDARY NONFERROUS METALS	1,735	216	12.45
2822	SYNTHETIC RUBBER	488	56	11.48
3355	ALUMINUM ROLLING/DRAWING, NEC	250	28	11.20
3691	STORAGE BATTERIES	529	59	11.15
3275	GYPSUM PRODUCTS	139	15	10.79
2819	IND. INORGANIC CHEMICALS, NEC	11,107	1,166	10.50
3339	PRIMARY NONFERROUS METALS, NEC	160	15	9.38
3843	DENTAL EQUIPMENT AND SUPPLIES	584	53	9.08
2611	PULP MILLS	1,063	96	9.03
2253	KNIT OUTERWEAR MILLS	7,386	608	8.23
2297	NONWOVEN FABRICS	317	25	7.89
2077	ANIMAL & MARINE FATS AND OILS	89	7	7.87
4911	ELECTRIC SERVICES	7,193	564	7.84
3322	MALLEABLE IRON FOUNDRIES	1,675	129	7.70
2082	MALT BEVERAGES	6,886	512	7.44
7391	RESEARCH DEVELOPMENT LAB.	23,975	1,679	7.00
2899	CHEMICAL PREPARATIONS, NEC	1,872	131	7.00
3111	LEATHER TANNING AND FINISHING	474	32	6.75
3911	JEWELRY, PRECIOUS METAL	1,885	126	6.68
2641	PAPER COATING AND GLAZING	1,618	107	6.61
3255	CLAY REFRACTORIES	1,701	112	6.58
0723	CROP PREP. SERVCES FOR MARKET	77	5	6.49
2084	WINES/BRANDY & BRANDY SPIRITS	150	9	6.00
4952	SEWERAGE SYSTEMS	119	7	5.88
4941	WATER SUPPLY	631	36	5.71
2075	SOYBEAN OIL MILLS	459	25	5.45
2241	NARROW FABRIC MILLS	361	19	5.26
3829	MEASURING/CONTROL.DEVS NEC	1,529	80	5.23
1541	INDUST. BUILDINGS/WAREHOUSES	5,249	273	5.20

NIOSH 1972 NATIONAL OCCUPATIONAL HAZARD SURVEY

SIC CODE	INDUSTRY NAME	TOTAL ON PAYROLL	TOTAL EXPOSED	PERCENT EXPOSED
2843	SURFACE ACTIVE AGENTS	339	168	49.56
2833	MEDICINALS AND BOTANICALS	618	252	40.78
8071	MEDICAL LABORATORIES	111	39	35.14
2871	FERTILIZERS	306	106	34.64
3471	PLATING AND POLISHING	722	227	31.44

2879	AGRICULTURAL CHEMICALS, NEC	56	17	30.36
3691	STORAGE BATTERIES	995	286	28.74
2231	WEAVING AND FINISHING MILLS,	67	19	28.36
5962	HAY, GRAIN, AND FEED STORES	11	3	27.27
8021	OFFICES OF DENTISTS, DENTAL S	22	5	22.73
5541	GASOLINE SERVICE STATIONS	382	85	22.25
2818	INDUSTRIAL ORGANIC CHEMICALS	1,362	258	18.94
2815	CYCLIC INTERMEDIATES AND CRUD	160	28	17.50
3111	LEATHER TANNING AND FINISHING	1,522	263	17.28
2753	ENGRAVING AND PLATE PRINTING	43	7	16.28
2816	INORGANIC PIGMENTS	708	100	14.12
1752	FLOOR LAYING AND FLOOR WORK	188	22	11.70
7221	PHOTOGRAPHIC STUDIOS	27	3	11.11
2831	BIOLOGICAL PRODUCTS	7,046	751	10.66
3351	COPPER ROLLING AND DRAWING	1,836	192	10.46
2819	INDUSTRIAL INORGANIC CHEMICAL	2,679	280	10.45
3963	BUTTONS	106	11	10.38
2591	VENETIAN BLINDS AND SHADES	482	50	10.37
3339	PRIMARY NONFERROUS METALS, NE	528	53	10.04
7397	COMMERCIAL TESTING LABORATORI	22	2	9.09
4521	NONCERTIFICATED AIR TRANSPORT	191	17	8.90
5531	TIRE, BATTERY, AND ACCESSORY	147	13	8.84
4952	SEWERAGE SYSTEMS	34	3	8.82
2083	MALT	37	3	8.11
2822	SYNTHETIC RUBBER	1,798	140	7.79
2841	SOAP AND OTHER DETERGENTS	536	41	7.65
7391	RESEARCH & DEVELOPMENT LABORA	938	71	7.57
2834	PHARMACEUTICAL PREPARATIONS	993	71	7.15
5084	INDUSTRIAL MACHINERY AND EQUI	742	51	6.87
2649	CONVERTED PAPER PRODUCTS, NEC	555	38	6.85
2641	PAPER COATING AND GLAZING	1,734	118	6.81
3031	RECLAIMED RUBBER	30	2	6.67
1389	OIL AND GAS FIELD SERVICES, N	280	18	6.43
7539	AUTOMOBILE REPAIR SHOPS, NEC	32	2	6.25
2899	CHEMICAL PREPARATIONS, NEC	1,050	65	6.19
3519	INTERNAL COMBUSTION ENGINES,	12,867	776	6.03
3911	JEWELRY, PRECIOUS METAL	622	37	5.95
2821	PLASTICS MATERIALS AND RESINS	1,719	98	5.70
2262	FINISHING PLANTS, SYNTHETICS	936	53	5.66
2294	PROCESSED TEXTILE WASTE	487	27	5.54
2791	TYPESETTING	201	11	5.47
2793	PHOTOENGRAVING	148	8	5.41
3297	NONCLAY REFRACTORIES	74	4	5.41
0722	VETERINARIANS AND ANIMAL HOSP	130	7	5.38
3356	NONFERROUS ROLLING AND DRAWIN	484	26	5.37
5081	COMMERCIAL MACHINES AND EQUIP	822	42	5.11
5252	FARM EQUIPMENT DEALERS	98	5	5.10
2269	FINISHING PLANTS, NEC	316	16	5.06
8011	OFFICES OF PHYSICIANS AND SUR	539	27	5.01

OSHA/EXPOSURE DATA

NONE

ENGINEERING CONTROLS

General ventilation; local exhaust ventilation; hood; enclosure of process or worker.

PERSONAL PROTECTIVE EQUIPMENT

Chemical goggles, face screens, gloves, neoprene or polyvinyl chloride boots and acid-resistant trousers, the legs of which should fall over the boots and not be tucked into them. [ENCYC OCCUPAT HEALTH & SAFETY 1983]
Laboratory protective equipment: goggles and shield; lab coat and apron; vent hood; proper gloves. Respiratory protection should be as follows: Up to 25 mg/m3: powered air-purifying respirator with a high-efficiency particulate filter and an acid gas cartridge or canister; any supplied-air respirator operated in a continuous flow mode. Substance causes eye irritation or damage; eye protection needed. Up to 50 mg/m3: any chemical cartridge respirator with a full facepiece and acid gas cartridge(s) in combination with a high-efficiency particulate filter; any self-contained breathing apparatus with a full facepiece or any supplied-air respirator with a full facepiece; any air-purifying full facepiece respirator (gas mask) with a chin-style or front- or back-mounted acid gas canister having a high-efficiency particulate filter. Up to 80 mg/m3: any supplied-air respirator with a full facepiece and operated in a pressure-demand or other positive pressure mode. Emergency or planned entry in unknown concentration or IDLH conditions: any self-contained breathing apparatus with full facepiece and operated in a pressure-demand or other positive pressure mode or any supplied-air respirator with a full facepiece and operated in pressure-demand or other positive pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive pressure mode. Escape: any air purifying full facepiece respirator (gas mask) with a chin-style or front- or back-mounted acid gas canister having a high-efficiency particulate filter or any appropriate escape-type self-contained breathing apparatus. [NIOSH: POCKET GUIDE TO CHEMICAL HAZARDS P. 213 (1987) DHEW (NIOSH) PUB NO. 85-114]

STORAGE

Vent hood storage color code: white (corrosive). Special precautions: keep container tightly closed. Store in corrosion-proof area. Protect containers against physical damage and prevent contact with water. Separate from carbides, chlorates, fulminates, nitrates, picrates, powdered metals and combustible materials. [THE INTERNATIONAL INSTITUTE, TOXIC & HAZARDOUS INDUSTRIAL CHEMICALS SAFETY MANUAL, 1986, P. 499]

Material Safety Data Sheet

307-766
Rev. B

GRACO

Information is provided to comply with OSHA's Hazard Communication Standard, 29 CFR 1910 1200.

IDENTITY *(As Used on Label and List)*

NOTE: Blank spaces are not permitted. If any item is not applicable (NA) or no information is available (INA), the space must be marked to indicate that.

HYDRAULIC FLUID

Section I

Manufacturer's Name	Telephone Number for FURTHER INFORMATION	Telephone Number for MEDICAL EMERGENCY ONLY
Graco Inc.	612/623-6111	303/623-5716

Address *(Number, Street, City, State & Zip Code)*		Date Prepared	Date Revised
P.O. Box 1441	60 11th Ave. N.E.	11-8-85	6-18-86
Minneapolis, Minnesota 55440	Minneapolis, Minnesota 55413		

Section II—Hazardous Ingredients/Identity Information

Components *(Specific Chemical Identity; Common Name(s))*	CAS Registry No.	% *(Optional)*	OSHA PEL	ACGIH TLV	Other Limits Recommended	Listed as a Carcinogen or Potential Carcinogen in NTP, IARC or OSHA (1910(z) (specify)
Petroleum hydrocarbon industrial oil		100 mixture				
Oil mist, if generated			5 mg/m³			
Identity of ingredients that are trade secrets are excluded from this list.			INA			

Section III—Physical/Chemical Characteristics

Boiling Point Above 600°F	Specific Gravity (H_2O - 1) 0.88-0.89
Vapor Pressure (mm Hg.) INA	Melting Point NA
Vapor Density (AIR - 1) Heavier than air	Evaporation Rate (Butyl Acetate - 1) INA
Solubility in Water Negligible	
Appearance and Odor Clear to yellow, characteristic odor	

Section IV—Fire and Explosion Hazard Data

Flash Point (Method Used)	Flammable Limits	LEL	UEL
410°F (COC)		INA	INA

Extinguishing Media
Dry chemical, CO_2, water spray, foam, sand or earth

Special Fire Fighting Procedures
Water spray may be useful in minimizing vapors and cooling containers exposed to heat & flame. Avoid spreading burning liquid wit water used for cooling purposes. See HAZARDOUS DECOMPOSITION, Section V.

Unusual Fire and Explosion Hazards
Material will burn, but will not ignite readily.

Section V—Reactivity Data

Stability:	Unstable	Stable	Conditions to Avoid:
		X	Avoid contact with any source of ignition

Incompatability *(Materials to Avoid)*
Avoid contact with strong oxidizing agents. Extended exposure to high temperatures may cause decomposition.

Hazardous Decomposition or Byproducts:
Thermal decomposition in the presence of air may yield major amounts of oxides of carbon and minor amounts of oxides of sulfur an nitrogen.

Hazardous Polymerization:	May Occur	Will Not Occur	Conditions to Avoid:
		X	

Primary Route(s) of Entry:
INA

Health Hazards *(Acute and Chronic)*

EYE CONTACT: This material may cause eye irritation. Direct contact may cause burning, tearing and redness.
SKIN CONTACT: This material may cause skin irritation. Prolonged or repeated contact may cause redness, burning and dermatitis.
INHALATION (BREATHING): Exposure to mists, or prolonged or repeated exposure to fumes or vapors that may be generated when this material is heated, may cause irritation of nose and throat.
INGESTION (SWALLOWING): Accidental ingestion of this material may cause irritation of the digestive tract.

Signs and Symptoms of Exposure
See Health Hazards

Medical Conditions Generally Aggravated by Overexposure
INA

Emergency and First Aid Procedures

EYES: For direct contact, flush the affected eye(s) with clean water. If irritation or redness develops, seek medical attention.

SKIN: Do not use gasolines, thinner or solvents to remove product from skin. Wipe material from skin and remove contaminated clothing. Cleanse affected area(s) thoroughly by washing with soap and water and, if necessary, a waterless skin cleanser. If irritation or redness develops and persists, seek medical attention.

INHALATION (Breathing): If irritation of nose or throat develops, move away from source of exposure and into fresh air. If irritation persists, seek medical attention. If victim is not breathing or if breathing difficulties develop, artifical respiration or oxygen should be administered by qualified personnel. Seek immediate medical attention.

INGESTION (Swallowing): If victim is conscious and alert, give 2 to 3 cups of milk or water to drink. Seek medical attention.

TO PHYSICIAN: Emesis or lavage is not recommended for ingestions or minute quantities or tastes of most hydrocarbons. Medical opinion is divided for larger ingestions. Emesis or lavage has been recommended for those petroleum products which have a high oral toxicity. Gastric lavage with a cuffed endotracheal tube is recommended by some physicians to prevent aspiration.

Section VII—Procedures for Spills and Disposal

Steps to be Taken in Case Material is Released or Spilled:
Collect leaking liquid in sealable containers. Absorb spilled liquid in sand or inert absorbant.

Waste Disposal Method
Dispose of product in accordance with local, county, state, and federal regulations.

Section VIII—Handling and Storage

Precautions to Be Taken in Handling and Storing
Store in a cool, dry location. Keep away from incompatible materials (See Section V). Avoid generating oil mists while handling. Avoid prolonged or repeated skin contact. Wash thoroughly after handling. Do not wear oil-soaked clothing or shoes.

Other Precautions
INA

Section IX—Protective Equipment and Clothing

Respiratory Protection *(Specify Type)*
If airborne concentrations exceed recommended exposure limits, a suitable filter-type respirator should be worn (See Section VI).

Ventilation: Local Exhaust — Special
If current ventilation practices are not adequate in maintaining airborne concentrations below the established exposure limits (see Section I), additional ventilation or exhaust systems may be required.

Mechanical *(General)* — Other

Eye Protection:
Recommend eye protection to safeguard against potential eye contact, irritation or injury.

Protective Gloves:
Advise use of gloves impermeable to the material handled to prevent skin contact and possible irritation.

Other Protective Clothing or Equipment:
It is suggested that a source of clean water be available in work area for flushing eyes and skin. Recommend barrier creams that are specific for oil-based materials when gloves are impractical.

Work/Hygienic Practices:
Standard industrial hygiene practices.

FD

U.S. DEPARTMENT OF LABOR
Occupational Safety and Health Administration

Form Approved OMB No. 44-R1387

MATERIAL SAFETY DATA SHEET

Rev. 10/81

Required under USDL Safety and Health Regulations for Ship Repairing, Shipbuilding, and Shipbreaking (29 CFR 1915, 1916, 1917)

SECTION I

MANUFACTURER'S NAME: Eagle-Picher Industries, Inc.	EMERGENCY TELEPHONE NO.: 513 721-7010
ADDRESS (Number, Street, City, State, and ZIP Code): 580 Building, P.O. Box 779, Cincinnati, Ohio 45201	
CHEMICAL NAME AND SYNONYMS: Diatomaceous earth	TRADE NAME AND SYNONYMS: Floor-Dry
CHEMICAL FAMILY: Amorphous or opaline silica	FORMULA: Predominantly SiO_2 (Amorphous)

SECTION II - HAZARDOUS INGREDIENTS

PAINTS, PRESERVATIVES, & SOLVENTS		%	TLV (Units)	ALLOYS AND METALLIC COATINGS		%	TLV (Units)
PIGMENTS	Does not apply			BASE METAL	Does not apply		
CATALYST	" " "			ALLOYS	" " "		
VEHICLE	" " "			METALLIC COATINGS	" "		
SOLVENTS	" " "			FILLER METAL PLUS COATING OR CORE FLUX	" " "		
ADDITIVES	" " "			OTHERS	" " "		
OTHERS	" " "						

HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES	%	TLV (Units)
See Section V		

SECTION III - PHYSICAL DATA

BOILING POINT (°F.)	4050°F.	SPECIFIC GRAVITY (H_2O=1)	2.2
VAPOR PRESSURE (mm Hg.)	?	PERCENT, VOLATILE BY VOLUME (%)	0.0
VAPOR DENSITY (AIR=1)	?	EVAPORATION RATE (______ =1)	0.0
SOLUBILITY IN WATER	0.5-2%		
APPEARANCE AND ODOR	Granular material - no odor		

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (Method used): None	FLAMMABLE LIMITS: Will not burn	Lel	Uel

EXTINGUISHING MEDIA
Does not apply

SPECIAL FIRE FIGHTING PROCEDURES
None required, will not burn

UNUSUAL FIRE AND EXPLOSION HAZARDS
None

(Continued on reverse side)

SECTION V - HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE See General Industry Standards (OSHA) Sec. 1910.1000 Table Z-3

EFFECTS OF OVEREXPOSURE Inhalation of quantities of dust in excess of TLV recommended by OSHA over an extended number of years may produce pulmonary impairment.

EMERGENCY AND FIRST AID PROCEDURES

SECTION VI - REACTIVITY DATA

STABILITY			CONDITIONS TO AVOID
	UNSTABLE		
	STABLE	X	

INCOMPATABILITY *(Materials to avoid)* Hydrofluoric Acid

HAZARDOUS DECOMPOSITION PRODUCTS None

HAZARDOUS POLYMERIZATION			CONDITIONS TO AVOID
	MAY OCCUR		
	WILL NOT OCCUR	X	

SECTION VII - SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

Non Toxic. Vacuum clean spillage, wet sweep or wash away

WASTE DISPOSAL METHOD

Non-Biodegradable – use solid waste disposal common to land fill type operation or similar disposal.

SECTION VIII - SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION *(Specify type)* NIOSH or MHSA (formerly MESA) approved respirators.

VENTILATION		
	LOCAL EXHAUST: Control within TLV	SPECIAL
	MECHANICAL *(General)*	OTHER

PROTECTIVE GLOVES Normally not necessary

EYE PROTECTION Normally not necessary

OTHER PROTECTIVE EQUIPMENT Normally not necessary

SECTION IX - SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING

Maintain good houskeeping practices. Avoid creating dust.

OTHER PRECAUTIONS

MATERIAL SAFETY DATA SHEET

EAGLE-PICHER INDUSTRIES, INCORPORATED
MINERALS DIVISION
PO BOX 12130, RENO, NEVADA, 89510
702-322-3331

#7601

DATE ISSUED: 11/18/85 DATE REVISED: -

1. IDENTIFICATION

PRODUCT NAME: FLOOR DRY; SUPER FINE, DIALOAM, CELATOM MP GRADES
CHEMICAL FAMILY: AMORPHOUS SILICA CHEMICAL FORMULA: O2Si
CAS #: 7631-86-9 W% 100% V% 100%
CHEMICAL NAME: DIATOMACEOUS EARTH, CALCINED
LISTED AS A CARCINOGEN IN NTP, IARC, OR OSHA 1910(Z) - NO
HAZARD MATERIAL DESCRIPTION, PROPER SHIPPING NAME, HAZARD ID NO.
(49CFR172.101) - DOES NOT APPLY
ADDITIONAL HAZARD CLASS - DOES NOT APPLY

2. PHYSICAL DATA

BOILING POINT: 4050 DEG. F
VAPOR PRESSURE: NOT APPLICABLE
VAPOR DENSITY: NOT APPLICABLE
EVAPORATION RATE: NOT APPLICABLE
% VOLATILE: NOT APPLICABLE
SOLUBILITY IN H2O: < 2%
SPECIFIC GRAVITY: 2.2
% SOLID BY WEIGHT: 100%
pH: (10% SLURRY) 6.0-8.0
APPEARANCE: ODORLESS GRANULAR PDODUCT, BUFF TO OFF-WHITE

3. FIRE AND EXPLOSION HAZARD DATA

FLASH POINT: NOT APPLICABLE
FLAMMABLE LIMITS: LEL - NOT APPLICABLE UEL - NOT APPLICABLE
EXTINGUISHING MEDIA: NOT APPLICABLE
SPECIAL FIRE FIGHTING PROCEDURES: NOT APPLICABLE
UNUSUAL FIRE AND EXPLOSION HAZARDS: NOT APPLICABLE

4. HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE: 1.25 MG./ CU M.
PERMISSIBLE EXPOSURE LIMIT: 1.25 MG./ CU M.
EFFECTS OF OVEREXPOSURE-CONDITIONS TO AVOID: INHALATION OF DUST IN EXCESS OF TLV RECOMMENDED BY ACGIH OVER AN EXTENDED NUMBER OF YEARS MAY PRODUCE PNEUMOCONIOSIS.
PRIMARY ROUTES OF ENTRY: INHALATION (X), SKIN CONTACT ( ), OTHER( )
EMERGENCY AND FIRST AID PROCEDURES: NONE REQUIRED
HAZARDOUS INGREDIENTS: ANALYSES BY X-RAY DIFFRACTION HAVE SHOWN THE PRODUCTS LISTED ON THIS SHEET TO CONTAIN BETWEEN 0% AND 2% CRYSTALLINE SILICA AS CRISTOBALITE WITH AN AVERAGE CONCENTRATION OF 0.8%. REFER TO THE ATTACHED FOR AN EXPLANATION OF TLV AND PEL.

5. REACTIVITY DATA

STABILITY: STABLE (X) UNSTABLE ( )
CONDITIONS TO AVOID:NOT APPLICABLE
INCOMPATIBILITY (materials to avoid): HYDROFLUORIC ACID, HYDROGENATED VEGATABLE OILS
HAZARDOUS DECOMPOSITION PRODUCTS:NOT APPLICABLE
HAZARDOUS POLYMERIZATION: MAY OCCUR ( ) , WILL NOT OCCUR (X)
CONDITIONS TO AVOID:NOT APPLICABLE

6. SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED: NONTOXIC, VACUUM CLEAN SPILLAGE, WET SWEEP OR WASH AWAY

WASTE DISPOSAL METHOD:NON-BIODEGRADABLE, USE SOLID WASTE DISPOSAL COMMON TO LANDFILL TYPE OPERATIONS OR SIMILAR DISPOSAL OR IN SLURRY TO SUMPS.

7. SPECIAL PROTECTION INFORMATION

RESIRATORY PROTECTION: BUREAU OF MINES OR NIOSH APPROVED RESPIRATORS FOR PROTECTION AGAINST PNEUMOCONIOSIS:PRODUCING DUST RECOMMENDED WHEN CONCENTRATIONS OF DUST EXCEED RECOMMENDED TLV.
VENTILATION:LOCAL - CONTROL WITHIN TLV
PROTECTIVE GLOVES: NOT NORMALLY NECESSARY
EYE PROTECTION:NOT NORMALLY NECESSARY
OTHER PROTECTIVE EQUIPMENT: NOT NORMALLY NECESSARY

8. SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING: MAINTAIN GOOD HOUSEKEEPING PRACTICES - AVOID CREATING DUST
OTHER PRECAUTIONS: SEE CAUTION LABEL ON BAG

NAME:R.W. PIEKARZ, PE.
SIGNATURE: R.W. Piekarz
TITLE:VP ENGRG & ENVIR
DATE:NOVEMBER 18, 1985

NOTICE: WHILE THE INFORMATION AND RECOMMENDATIONS SET FORTH HEREIN ARE BELIEVED TO BE ACCURATE AS OF THE DATE HEREOF, EAGLE-PICHER INDUSTRIES, INC. MAKES NO WARRANTY IN RESPECT THERETO AND DISCLAIMS ALL LIABILITY FROM RELIANCE THEREON. (AS OF THIS DATE THERE ARE NO UNIVERSALLY ACCEPTABLE STANDARDS FOR CRISTOBALITE.)

COMPUTATION OF TLV

TABLE Z-3: An employee's exposure to any material listed in Table Z-3, in any 8-hour work shift of a 40-hour work week, shall not exceed the 8-hour time weighted average limit (TLV) given for that material in the table.

TABLE Z-3 - MINERALS DUSTS **

SUBSTANCE	Mppcf	Mg/CU. M.
SILICA:		
CRYSTALLINE:		
QUARTZ (Respirable)	$\frac{250}{\%SiO_2+5}$	$\frac{10 \text{ Mg/CU. M.*}}{\%SiO_2 + 2}$
QUARTZ (Total Dust)		$\frac{30 \text{ Mg/CU. M.}}{\%SiO_2 + 3}$

CRISTOBALITE: Use 1/2 the value calculated from the count or mass formulae for quartz.

TRIDYMITE: Use 1/2 the value calculated from the formulae for quartz.

AMORPHOUS DIATOMACEOUS EARTH	20 Mppcf	1.5 Mg/CU.M#

* The percentage of Cyrstalline Silica in the formula is the amount determined from airborne samples except in those instances in which other methods have been shown to be applicable.

\# From 1985-86 ACGIH Threshold limit values, Table 1, equivalent TLV's in Mppcf and Mg./CU.M. (respirable mass) for mineral dusts.

** Table Z-3 - Minerals Dusts - Code of Federal Regulations, Title 29, Chapter XVII, Part 1910, Subpart Z; revised as of July 1, 1979, etc, etc., amended by 48 FR 53280, November 25, 1983.

PEL computation based on the same formulae.

EAGLE EP PICHER **CELATOM**

Technical Data
Celatom Products
Minerals Division

CELATOM
MP-78

EAGLE-PICHER INDUSTRIES, INC • 580 Walnut Street, P.O. Box 779, Cincinnati, Ohio 45201 • Processing Plants: Clark & Colado, Nevada

CELATOM MP-78

Celatom MP-78 is a calcined diatomaceous earth processed for use as a light weight general fill, absorbing compound, and may be incorporated in products that require an optimum ratio between light density and high melting point.

It is essentially pure amorphous silica and as such may be used by those requiring a silica source.

Physical Properties (Typical)

Screen Analysis (Tyler)	
+20 Mesh	15%
-20 +28 Mesh	28%
-28 +65 Mesh	48%
-65 Mesh	9%
Apparent Dry Density (lbs./cu.ft.) (tapped)	25.0
Moisture (24 Hr. Oven Dry Method)	0.1%
Oil Absorption (Gardner-Coleman) (lbs./100 lbs.)	101.7
pH	7.0
Crushing Strength (.125" comp./1' column) (lbs./sq.in.)	221
Particles per Pound	16.56 million
Color	Light Tan
Structure	Predominantly amorphous diatomaceous silica

Chemical Analysis (Approximate)

Silica (SiO_2)	90.0%
Alumina (Al_2O_3)	6.5%
Iron Oxide (Fe_2O_3)	2.3%
Lime (CaO)	0.2%
Magnesia (MgO)	0.3%
Other Oxides	0.3%
Ignition Loss (In addition to Moisture at 105°)	0.4%

7/79

The high purity of Eagle-Picher's Celatom deposits in Storey and Pershing Counties, Nevada, their proximity to the surface, [illegible]

exceedingly dependable source of diatomaceous silica. Our flexible milling, classifying, calcining and flux-calcining facilities for producing the wide variety of grades of Celatom are

Gasoline
(CAS NUMBER: 8006-61-9)

SYNONYMS

Petrol/Motor spirits/Benzin

TRADE NAMES

NONE

DESCRIPTION OF SUBSTANCE

Gasoline is clear, flammable, volatile liquid with a characteristic odor. It is a complex mixture of paraffinic, olefinic, and aromatic hydrocarbons ranging from C3 to C11 compounds. These number as many as 250 separate hydrocarbons in various commercial gasolines. [ACGIH, P.283, 1986]

HEALTH EFFECTS

Gasoline is irritating to skin, conjunctiva, and mucous membranes. Dermatitis may result from repeated and prolonged contact with the liquid, which may develop hypersensitivity. Gasoline vapor acts as a central nervous system depressant. Exposure to low concentrations may produce flushing of the face, staggering gait, slurred speech, and mental confusion. In high concentrations, gasoline vapor may cause unconsciousness, coma, and possibly death resulting from respiratory failure. Other signs also may develop following acute exposure. These signs are early acute hemorrhage of the pancreas, centrilobular cloudy swelling and fatty degeneration of the liver, fatty degeneration of the proximal convoluted tubules and glomeruli of the kidneys, and passive congestion of the spleen. Ingestion and aspiration of the liquid gasoline usually occurs during siphoning. Chemical pneumonitis, pulmonary edema, and hemorrhage may follow. Aromatic hydrocarbon content may also cause hematopoietic changes. Absorption of alkyl lead antiknock agents contained in many gasolines poses an additional problem especially where there is prolonged skin contact. The existence of chronic poisoning has not been established. [SITTIG, P. 471, 1985]

TOXICITY/EXPOSURE LIMITS

NFPA RATING -	Flammability	- 3	Severe
	Health	- 1	Slight
	Reactivity	- 0	None

TOXICITY HAZARD RATING - 3.3 = Moderately toxic: probable oral lethal dose (human) 0.5-5 gm/kg between 1 ounce and 1 pint (or 1 lb.) for 70 kg person (150 lbs.). [GOSSELIN CTCP 5TH ED 1984]

Acute and chronic local: skin 3-2; mucous membranes 3-2; eyes 3-2. Acute and chronic systemic: ingestion 3-2; inhalation 3-2; skin 3-2. 3 = High: may cause death or permanent injury after exposure to small quantities. 2 = Moderate: may involve both irreversible and reversible changes not severe enough to cause death or permanent injury. [SAX. DANGER PROPS INDUS MATER 6TH ED p.1471, 1984]

IMMEDIATELY DANGEROUS TO LIFE OR HEALTH - NONE

OSHA PEL - 300.000 ppm, 900.000 mg/m3;TWA
500.000 ppm, 1500.000 mg/m3;STEL

ADOPTED ACGIH/TLV - 300.000 ppm, 900.000 mg/m3;TWA
500.000 ppm, 1500.000 mg/m3;STEL

NIOSH/REL - NONE

INDUSTRY USE DATA

Gasoline is used as a fuel, diluent and solvent throughout industry. [SITTIG, P.471, 1985]

NIOSH 1982 NATIONAL OCCUPATIONAL EXPOSURE SURVEY

NONE

NIOSH 1972 NATIONAL OCCUPATIONAL HAZARD SURVEY

NONE

OSHA/EXPOSURE DATA

NONE

ENGINEERING CONTROLS

General ventilation; local exhaust ventilation; hood; enclosure of process or worker.

PERSONAL PROTECTIVE EQUIPMENT

Barrier creams and impervious gloves; protective clothing. Masks in heavy exposure to vapors. [SITTIG, P.471, 1985]

STORAGE

NONE

3964	NEEDLES, PINS, AND FASTENERS	603	36	5.97
4941	WATER SUPPLY	631	36	5.71
2833	MEDICINALS AND BOTANICALS	2,347	133	5.67
3322	MALLEABLE IRON FOUNDRIES	1,675	93	5.55
3911	JEWELRY, PRECIOUS METAL	1,885	99	5.25

NIOSH 1972 NATIONAL OCCUPATIONAL HAZARD SURVEY

SIC CODE	INDUSTRY NAME	TOTAL ON PAYROLL	TOTAL EXPOSED	PERCENT EXPOSED
2833	MEDICINALS AND BOTANICALS	618	235	38.03
8071	MEDICAL LABORATORIES	111	37	33.33
3471	PLATING AND POLISHING	722	112	15.51
3313	ELECTROMETALLURGICAL PRODUCTS	147	20	13.61
2834	PHARMACEUTICAL PREPARATIONS	993	111	11.18
3399	PRIMARY METAL PRODUCTS, NEC	230	21	9.13
7397	COMMERCIAL TESTING LABORATORI	22	2	9.09
4952	SEWERAGE SYSTEMS	34	3	8.82
2793	PHOTOENGRAVING	148	13	8.78
3339	PRIMARY NONFERROUS METALS, NE	528	45	8.52
3576	SCALES AND BALANCES	95	8	8.42
2818	INDUSTRIAL ORGANIC CHEMICALS	1,362	109	8.00
2819	INDUSTRIAL INORGANIC CHEMICAL	2,679	191	7.13
2753	ENGRAVING AND PLATE PRINTING	43	3	6.98
2649	CONVERTED PAPER PRODUCTS, NEC	555	38	6.85
3031	RECLAIMED RUBBER	30	2	6.67
7391	RESEARCH & DEVELOPMENT LABORA	938	49	5.22

OSHA/EXPOSURE DATA

NONE

ENGINEERING CONTROLS

General ventilation; local exhaust ventilation; hood; enclosure of process or worker.

PERSONAL PROTECTIVE EQUIPMENT

Do not handle broken packages without protective equipment. [(C) AAR, 1986]
Wear a rubber acid suit, hood, boots and gloves; chemical goggles; a safety shower and eye bath should be provided. [CHRIS. HAZARD CHEM DATA MANUAL. 2 1978]
Vendor recommendations concerning the protective qualities of materials are as follows: natural rubber, neoprene, nitrile, anc polyvinyl chloride received C (fair) or D (poor) ratings from three or more vendors. Butyl, neoprene-styrene-butadiene, chlorinated polyethylene, and styrene butadiene received C or [ratings from less than three vendors, B (good) and C ratings - with C's predominating - from several vendors; Viton received (highest) or B ratings from less than three vendors, no C's or

D's, B and C ratings - with B's predominating - from several vendors. [ACGIH; GUIDELINES SELECT OF CHEM PROTECT CLOTHING VOLUME #1 FIELD GUIDE P. 65 (1983)]
Respiratory protection should be as follows: Up to 125 mg/m3: any supplied air respirator operated in a continuous flow mode. Substance reported to cause eye irritation or damage: may require eye protection. Up to 250 mg/m3: any self-contained breathing apparatus with a full facepiece or any supplied-air respirator with a full facepiece; any air-purifying full facepiece respirator (gas mask) with a chin-style or front- or back- mounted canister providing protection against the compound of concern. Only non-oxidizable sorbents are allowed (not charcoal); any chemical cartridge respirator with a full facepiece and cartridge(s) providing protection against the compound of concern. Emergency or planned entry in unknown concentration or IDLH conditions: any self-contained breathing apparatus with full facepiece and operated in a pressure-demand or other positive pressure mode or any supplied-air respirator with a full facepiece and operated in pressure-demand or other positive pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive pressure mode. Escape: any air-purifying full facepiece respirator (gas mask) with a chin-style or front- or back-mounted canister providing protection against the compound of concern or any appropriate escape-type self-contained breathing apparatus. Only non-oxidizable sorbents are allowed (not charcoal). Any appropriate escape-type self-contained breathing apparatus. [NIOSH: POCKET GUIDE TO CHEMICAL HAZARDS P. 173 (1987) DHEW (NIOSH) PUB NO. 85-114]

STORAGE

Storage color code: yellow (reactive). Special precautions: keep container tightly closed. Store separately and away from flammable and combustible materials. General storage procedure: safeguard against mechanical injury of containers; isolate from turpentine, combustible materials, carbides, metallic powders, fulminates, picrates, or chlorates.

INDUSTRY USE DATA

Nitrapyrin is used as a fertilizer additive to control nitrification and to prevent loss of nitrogen in soil. [ACGIH, 1986]

NIOSH 1982 NATIONAL OCCUPATIONAL EXPOSURE SURVEY

NONE

NIOSH 1972 NATIONAL OCCUPATIONAL HAZARD SURVEY

NONE

OSHA/EXPOSURE DATA

NONE

ENGINEERING CONTROLS

General ventilation; local exhaust ventilation; hood; enclosure of process or worker.

PERSONAL PROTECTIVE EQUIPMENT

NONE

STORAGE

NONE

Nitric acid
(CAS NUMBER: 7697-37-2)

SYNONYMS

Aqua fortis/Azotic acid/Hydrogen nitrate/Nitryl hydroxide/Acide nitrique (French)/Acido nitrico (Italian)/Azotowy kwas (Polish)/Salpetersaure (German)/Salpeterzuuroplossingen (Dutch)/White fuming nitric acid/Red fuming nitric acid

TRADE NAMES

Nital.

DESCRIPTION OF SUBSTANCE

Nitric acid is a colorless, yellow, or red fuming liquid with a suffocating odor. It is soluble in water. [(C)AAR, 1986]

HEALTH EFFECTS

This compound is a primary irritant, and causes burns and ulceration of all tissues and membranes that it contacts. This includes burns to the eyes and skin by contact, burns to the mouth, throat, esophagus, and stomach by ingestion, and the entire respiratory tract by inhalation. Circulatory collapse and shock are often the immediate cause of death. Poisonous; may be fatal if inhaled, swallowed or absorbed through skin. In contact with eyes, causes immediate opacification of cornea and conjunctival epithelium, imparting yellow color when acid is concentrated. In accidental application to eyes of newborn children several eyes have been lost as result of corneal opacification, symblepharon, and shrinkage of globe. [GRANT. TOX OF THE EYE 1974]
Chronic exposure to the vapor or mist is reported to cause chronic bronchitis and may cause chemical pneumonitis. The vapor and mist may erode teeth. [ACGIH, 1986]
A 25-year-old truck driver developed, and 4 days after succumbed to, acute dyspnea some 3 weeks after inhaling a considerable amount of fumes while cleaning up spilled 60% nitric acid. All stages of extensive bronchiolitis and alveolitis obliterans were found. [SCHMID KO; PNEUMONOLOGIE 150 (2-4): 133-7 (1974)]

TOXICITY/EXPOSURE LIMITS

NFPA RATING -	Flammability	- 0	None
	Health	- 3	Severe
	Reactivity	- 0	None

TOXICITY HAZARD RATING - Acute and chronic local: skin 3; mucous membranes 3; eyes 3. Acute and chronic systemic: ingestion 3; inhalation 3; skin 3. 3= High: may

cause death or permanent injury
after exosure to small quantities.
[SAX. DANGER PROPS INDUS MATER 6TH
ED, P. 2002, 1984]

IMMEDIATELY DANGEROUS TO LIFE OR HEALTH - 100 ppm [NIOSH. 1985]

OSHA PEL -	2.000 ppm,	5.000	mg/m3;TWA
	4.000 ppm,	10.000	mg/m3;STEL

ADOPTED ACGIH/TLV -	2.000 ppm,	5.000 mg/m3;TWA
	4.000 ppm,	10.000 mg/m3;STEL

NIOSH/REL - 2.000 ppm, 5.000 mg/m3;TWA

INDUSTRY USE DATA

Nitric acid is used in the manufacturing of pharmaceuticals; for photo-engraving in printing industry, in jewelry manufacturing and in engineering industry. [ENCYC OCCUPAT HEALTH & SAFETY 1983]
It is also a chemical intermediate for ammonium nitrate, adipic acid, isocyanates, nitrobenzene, potassium nitrate, nitrocellulose lacquers, other aromatic nitrogen compound, nitroparaffins and nuclear fuel, fertilizers, explosives, and an agent in steel pickling. [SRI]
It finds veterinary uses and is used to manufacture dyes.

NIOSH 1982 NATIONAL OCCUPATIONAL EXPOSURE SURVEY

SIC CODE	INDUSTRY NAME	TOTAL ON PAYROLL	TOTAL EXPOSED	PERCENT EXPOSED
3463	NONFERROUS FORGINGS	26	24	92.31
3339	PRIMARY NONFERROUS METALS, NEC	160	65	40.63
3675	ELECTRONIC CAPACITORS	558	212	37.99
2891	ADHESIVES AND SEALANTS	832	245	29.45
2793	PHOTOENGRAVING	50	12	24.00
3825	INSTR. TO MEASURE ELECTRICITY	18,445	3,761	20.39
3353	ALUMINUM SHEET/PLATE/FOIL	346	69	19.94
2022	CHEESE, NATURAL AND PROCESSED	906	175	19.32
3471	PLATING AND POLISHING	1,512	288	19.05
2992	LUBRICATING OILS AND GREASES	546	84	15.38
3554	PAPER INDUSTRIES MACHINERY	3,330	500	15.02
3613	SWITCHGEAR/SWITCHBD APPARATUS	443	56	12.64
7397	COMMERCIAL TEST LABS	1,359	109	8.02
2822	SYNTHETIC RUBBER	488	36	7.38
2753	ENGRAVING AND PLATE PRINTING	82	6	7.32
2874	PHOSPHATIC FERTILIZERS	330	23	6.97
3493	STEEL SPRINGS, EXCEPT WIRE	728	50	6.87
3399	PRIMARY METAL PRODUCTS, NEC	162	11	6.79
7391	RESEARCH DEVELOPMENT LAB.	23,975	1,602	6.68
4583	AIRPORT TERMINAL SERVICES	4,458	292	6.55

MATERIAL SAFETY DATA SHEET
FOR PRINTING INK AND RELATED MATERIALS

Date of Prep.: 4/28/93

Supercedes: 6/26/91

Prepared by: PETER GIMSE

H.M.I.S RATINGS		
Minimal----0	HEALTH	1
Slight-----1	FLAMMABILITY	2
Moderate---2	REACTIVITY	0
Serious----3		
Severe-----4		

SECTION I -- PRODUCT IDENTIFICATION AND USE

Manufacturer's Name: DIAGRAPH CORPORATION Emergency Telephone #: 618-997-3321

Street address: P.O. BOX 520 City/St/Zip: HERRIN, ILLINOIS, U.S.A 62948

Product Class: INK Product Identification: 1301318

Trade Name: GS-3 WHITE INK

SECTION II -- HAZARDOUS INGREDIENTS

Ingredient CAS #	Hazard Data:
1.2-PENTANONE, 4-HYDROXY, 4-METHYL CAS # 123-42-2	%by wt. 20-40%, TLV 50 PPM LD50 - ORL RAT, 4000 Mg/Kg LC50 - UNKNOWN
2.PROPYLENE GLYCOL METHYL ETHER CAS # 107-98-2	%by wt. 0-20%, TLV 100 PPM LD50 - ORL RBT, 8000 Mg/Kg LC50 - IHL GPG, 15000 PPM/7H

** NOTES **

THIS PRODUCT CONTAINS NO CARCINOGENS OR REPRODUCTIVE TOXIC CHEMICALS AS LISTED BY NTP, IARC, OR OSHA. THIS PRODUCT CONTAINS NO INTENTIONALLY ADDED LEAD, MERCURY, CADMIUM, OR HEXAVALENT CHROMIUM METALS.
THIS INK COMPLIES TO SPECIFICATION CID A-A-208 FOR USE BY TYPE I, II, + IV APPLICATORS. NO CHEMICALS ARE LISTED ON SARA TITLE III, SECTION 313.

SECTION III -- PHYSICAL DATA

Boiling pt. (F/C): 180 F / 82 C	Vapor Density (H/L): vs. air HIGHER
Odor: SOLVENT	Appearance: WHITE LIQUID
Freezing pt. (F/C): UNKNOWN	Vapor Pressure: (mm Hg) UNKNOWN
pH: UNKNOWN	Specific Gravity: 1.296
Evap. rate: vs. Butyl Acetate (fast/slow): SLOWER	Liquid Density: vs. water * HEAVIER
Percent Volatile Wt.: 48%	Coeff. Water/ Oil Distribution: UNKNOWN

SECTION IV -- FIRE & EXPLOSION DATA

Can hazardous polymerization occur? NO Flammability (Y/N): YES

If yes, under what conditions: A VAPOR ACCUMULATION WILL FLASH AND OR EXPLODE IF IGNITED

Means of Extinction: Foam - X Alcohol Foam - CO2 - X Dry Chemical - X Water Fog - Other -	Flashpoint (F/C) (Closed Cup Method) 106 F / 41 C
Explosion Sensitive to impact: YES	--- Flammable Limit --- % by volume Upper : UNKNOWN Lower : 0.9
Classification: DOT: FLAMMABLE OSHA: COMBUSTIBLE II	Hazardous Combustion Products: CO, CO2, HYDROCARBONS
Autoignition temp. UNKNOWN	Sensitivity to Static Discharge: YES

Special Firefighting Procedures:
A STRAIGHT STREAM OF WATER COULD SPREAD FIRE

SECTION V -- HEALTH HAZARD DATA

Primary Route of Entry:
Dermal - X Eye Contact - X Inhalation - X Ingestion -

Effects of exposure to product:

Skin: MAY CAUSE DERMATITIS AND IRRITATION
Eye: MAY CAUSE REDNESS AND BLURRED VISION
Inhalation: MAY CAUSE IRRITATION, DIZZINESS, AND FATIGUE
Swallowing: MAY CAUSE VOMITING, IRRITATION, AND NAUSEA
Overexposure: MAY CAUSE KIDNEY AND LIVER DAMAGE

Exposure Limits: 50 PPM	Irritancy: YES	Carcinogen: NO
Sensitization to Product: NO	Mutagency: NO	Reproductive Toxicity: NO
Teratogeny: NO	Synergistic Products: NO	

Emergency First Aid Procedures:

Skin:	WASH WITH SOAP AND WATER
Eyes:	FLUSH WITH WATER FOR 15 MINUTES, CALL PHYSICIAN
Inhalation:	PROVIDE FRESH AIR AND REST, CALL PHYSICIAN
Ingestion:	DRINK SEVERAL GLASSES OF WATER, INDUCE VOMITING, CALL PHYSICIAN
Other:	CALL PHYSICIAN

SECTION VI -- REACTIVITY DATA

Chemically Stable?: YES
If no, describe conditions to avoid? NONE

Incompatibility with other substances: YES
If yes, which ones? STRONG OXIDIZERS AND CAUSTIC MATERIALS

Reactivity, and under which conditions?
AVOID OPEN FLAMES AND SPARKS

Hazardous Decomposition Products:
CO, CO2, HYDROCARBONS

SECTION VII -- SPECIAL PROTECTION INFORMATION

Pers. Protection: Eye: RECOMMENDED Gloves: RECOMMENDED - NON-ABSORBENT

Respirator: RECOMMENDED - ORGANIC VAPOR Footwear: RECOMMENDED - OIL RESISTAN

Clothing: USE AS NEEDED Other: (Specify) None

Ventilation:
NEEDED TO KEEP VAPOR CONCENTRATION BELOW T.L.V. LEVEL.

SECTION VIII -- SPECIAL PRECAUTIONS

Procedure when material spilled or released:
REMOVE ALL SOURCES OF IGNITION. ABSORB ON INERT MATERIAL.

Disposal Method:
COMPLY WITH FEDERAL, STATE, AND LOCAL REGULATIONS

Special Shipping Information:
COMPLY TO THE TITLE 49 TRANSPORTATION CODE OF FEDERAL REGULATIONS

Storing and Handling:
STORE IN COOL, DRY PLACE AWAY FROM ALL SOURCES OF IGNITION

Other:
ALL COMPONENTS OF THIS PRODUCT ARE LISTED IN THE EPA'S INVENTORY OF CHEMICAL SUBSTANCES AS REQUIRED UNDER THE TOXIC SUBSTANCES CONTROL ACT (TSCA)

MATERIAL SAFETY DATA SHEET
PRODUCT NAME: STAONAL Marking Crayons

MSDS NO.STA-6.6
PAGE 1

BINNEY & SMITH INC.
1100 CHURCH LANE
EASTON, PA 18044

TELEPHONE NOS.
EMERGENCY: 1-215-253-6271
INFORMATION: 1-800-272-9652

1. PRODUCT IDENTIFICATION

PRODUCT NAME(S): STAONAL Marking Crayons (Permanent & Waterproof) General Markers

PRODUCT COLORS/CODES: 52-0002

COLORS: BLACK, BLUE, BROWN, GREEN, ORANGE, RED, VIOLET, WHITE, YELLOW

2. HAZARDOUS INGREDIENTS

HAZARDOUS COMPONENTS	CAS NO.	OSHA PEL	TLV
Hydrous Calcium Magnesium Silicate	14807-96-6	2 mg/m^3	2 mg/m^3
Kaolin Clay	1332-58-7	10 mg/m^3	10 mg/m^3

3. PHYSICAL/CHEMICAL CHARACTERISTICS

BOILING POINT: <400°F.

FREEZING POINT: Not determined

VAPOR PRESSURE @ 20°C.: Not Applicable

VAPOR DENSITY (AIR=1): Not Applicable

EVAPORATION RATE (BUTYL ACETATE=1): Not Applicable

SPECIFIC GRAVITY (WATER=1): 0.9

SOLUBILITY IN WATER: Not soluble

APPEARANCE AND ODOR: Various Colors -No Odor

4. FIRE AND EXPLOSION HAZARD DATA

FLASH POINT AND METHOD: <400°F.

FLAMMABLE LIMITS IN AIR- % BY VOLUME: UPPER: None LOWER: 1%

EXTINGUISHING MEDIA: Foam, CO_2, Sand, Sodium Bicarbonate, or Halon 1211

SPECIAL FIRE FIGHTING PROCEDURES: Self-contained breathing apparatus

UNUSUAL FIRE OR EXPLOSION HAZARDS: Do not store with strong oxidizers

Post-it™ brand fax transmittal memo 7671	# of pages ▸ 2
To Susan Bohne	From Jo Ellen
Co. Advanced Mktg.	Co. Binney & Smith
Dept. Corp.	Phone # 1-800-CRAYOLA
Fax # 702-735-0147	Fax #

5. HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE: Not established

ROUTES OF ENTRY:
- **INHALATION:** Not Applicable
- **SKIN:** Not Applicable
- **INGESTION:** Possible

ACUTE OR CHRONIC HEALTH HAZARDS: None

EFFECTS OF OVEREXPOSURE: None known

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: None known

EMERGENCY AND FIRST AID:
- **EYES:** Flush with plenty of water for 15 mins. Call a physician.
- **SKIN:** Wash with soap and water
- **INGESTION:** Do not induce vomiting. Call physician or Poison Control Center.
- **INHALATION:** Remove person to fresh air.

CARCINOGENICITY: THE INGREDIENTS OF THIS PRODUCT ARE ON THE TOXIC SUBSTANCES CONTROL ACT (TSCA) INVENTORY.

6. REACTIVITY DATA

STABILITY: Stable

CONDITIONS TO AVOID: Avoid strong oxidizers

INCOMPATIBILITY (MATERIALS TO AVOID): Avoid strong oxidizers

HAZARDOUS DECOMPOSITION PRODUCTS: Carbon monoxide in the case of incomplete combustion.

HAZARDOUS POLYMERIZATION: Will not occur

CONDITIONS TO AVOID: None known

7. SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE OF RELEASE OR SPILL: Recover free product. Keep product out of sewers and watercourses by diking or impounding. Advise authorities if product enters sewers or watscourses. Assure conformity with applicable governmental regulations.

WASTE DISPOSAL METHOD: In accordance with Local, State and Federal Regulations.

PRECAUTIONS TO BE TAKEN IN HANDLING OR STORING: Store at room temperature.

8. SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION: None required

PROTECTIVE GLOVES: None required

EYE PROTECTION: None required

OTHER PROTECTIVE EQUIPMENT: Not required

OTHER PROTECTION: Clean, safe work practices

9. SPECIAL INFORMATION

VOC INFORMATION:

LBS. VOC PER GAL. OF COATING LESS WATER: 0.0

DATE PREPARED: 8/27/92
APPROVED BY: Phillip E. Moll

THE INFORMATION CONTAINED HEREIN IS PROVIDED FOR THE PURPOSE OF DISCLOSING PRODUCT HAZARDS AND DOES NOT CONSTITUTE PRODUCT SPECIFICATIONS. ALL WARRANTIES, EITHER EXPRESSED OR IMPLIED, ARE HEREBY DISCLAIMED.

*******MATERIAL SAFETY DATA SHEET*******

For Coatings, Resins and Related Materials

=2SF99

SECTION I-PRODUCT AND PREPARATION INFORMATION

MANUFACTURER: RUST-OLEUM CORPORATION
ADDRESS: 11 Hawthorn Parkway
Vernon Hills, IL
60061

EMERGENCY AND INFORMATION
TELEPHONE: (708)367-7700

PRODUCT CLASS: Aerosol
MANUFACTURERS CODE: 2324, 2333, 2344, 2345, 2354, 2363 and 2392
TRADE NAME: HARD HAT Marking Paints
DATE OF PREPARATION: July 26, 1990 (jco)

5H911 5H912 5H913 5H914 5H916 5H917

SECTION II-HAZARDOUS INGREDIENTS

INGREDIENT/CAS No	WT %	EXPOSURE LIMITS ACGIH-TLV	EXPOSURE LIMITS OSHA-PEL	LEL	mm Hg@20C
Toluene/108-88-3	15-18%	100ppm	100ppm	1.2%	22.0
Hexane/110-54-3	5-10%	50ppm	50ppm	1.2%	137.0
Xylol/1330-20-7	3-5%	100ppm	100ppm	1.0%	9.5
Ethylene glycol/107-21-1	0-4%	50ppm	50ppmC	3.2%	0.12
VM&P Naphtha/64742-89-8	1-3%	300ppm	NE	0.9%	2.0
Methyl alcohol/67-56-1**	0-4%	200ppm	200ppm	6.0%	96.0
Propane/74-98-6	15%*	NE	1000ppm	2.3%	40psia
Isobutane/75-28-5	10%*	NE	NE	1.9%	40psia

**This chemical in 2363 and 2392 only
* Nearest 5%
NE-not established NA-not applicable

SECTION III-PHYSICAL DATA

Boiling range: Below 0 F
Vapor density: <u>heavier</u> lighter than air
Evaporation Rate: faster <u>slower</u> (Ether=1)
% Volatile: 85% (by volume)
Wt/gal: NA
pH: NA

SECTION IV-FIRE AND EXPLOSION HAZARDS

Flammability Classification: Extremely Flammable
Flashpoint: <0 F (TCC)

DOT Classification: Consumer Commodity ORM-D

Extinguishing Media: NFPA Class B extinguishers (Carbon dioxide, dry chemical or foam)

Special Fire Fighting Procedures:

Full protective equipment including self-contained breathing apparatus should be used. Water spray may be ineffective. Water may be used to cool closed containers to prevent pressure build-up and possible autoignition or explosion. If water is used, fog nozzles are preferred.

Unusual Fire and Explosion Hazards:

Keep away from heat, electrical equipment, sparks and open flame. Closed containers may explode when exposed to extreme heat. DO NOT apply to hot surfaces.

SECTION V-HEALTH HAZARD DATA

EFFECTS OF OVEREXPOSURE:

Acute(Inhalation): Harmful if inhaled. May affect the brain and nervous system causing dizziness, headache or nausea. Repeated overexposures may lead progressively to staggering gait, confusion, unconsciousness or coma. Causes nose and throat irritation.

Acute(Skin or Eye Contact): Causes eye and skin irritation which can lead to dermatitis with repeated overexposures.

Ingestion: May cause gastrointestinal irritation, nausea, vomiting and diarrhea.

Chronic: Reports have shown repeated and prolonged occupational overexposure to solvents with permanent brain and nervous system damage. Overexposure to Xylol and Toluene in lab animals has shown liver, kidney, spleen and eye damage as well as anemia. In humans, overexposure has been found to cause liver and cardiac abnormalities. Overexposure to Hexane in high vapor concentrations (1000-1500ppm) over a period of several months has been shown to cause peripheral polyneuropathy which has the potential of becoming irreversible. Overexposure to Methyl Alcohol has been shown to affect the central nervous system especially the optic nerve. May be fatal or cause blindness if ingested.

EMERGENCY AND FIRST AID PROCEDURES:

Inhalation: Remove from exposure, restore breathing and notify a physician.

Eye Contact: Flush immediately with large amounts of water for at least 15 minutes. Notify a physician.

Skin Contact: Wash affected area with soap and water, remove contaminated clothing and wash before reuse.

Ingestion: DO NOT induce vomiting. Keep person warm, quiet and get medical attention. Aspiration of this material into the lungs can cause chemical pneumonitis which can be fatal.

SECTION VI-REACTIVITY DATA

Stability: Unstable <u>Stable</u> Incompatible: with strong oxidizing agents

Hazardous Decomposition Products: By open flame- Carbon monoxide and Carbon dioxide.

Hazardous Polymerization: Will Not Occur

SECTION VII-SPILL OR LEAK PROCEDURES

Release or Spill Procedures: Remove all sources of ignition, ventilate area and remove with inert absorbent and non-sparking tools

Waste Disposal Method: Dispose of according to local, state and federal regulations. DO NOT incinerate closed containers.

SECTION VIII-SPECIAL PROTECTION INFORMATION

Respiratiory Protection: Use NIOSH approved chemical cartridge respirator (TC23C) to remove solid airborne particles of overspray and organic vapors during spray application. In Confined Areas: Use NIOSH approved supplied-air respirators or hoods (TC19C).

Eye Protection: Use safety eyewear designed to protect against splash of liquids.

Other Protective Equipment: Use gloves to prevent prolonged contact with skin.

Ventilation: Provide general dilution or local exhaust ventilation in volume and pattern to keep TLV of hazardous ingredients below acceptable limits.

SECTION IX-SPECIAL PRECAUTIONS AND REGULATORY ISSUES

Handling and Storage Precautions: Do not store above 120F. DO NOT puncture or incinerate containers. Intentional misuse by deliberately concentrating and inhaling the contents can be harmful or fatal.

LIQUID AIR

AN AIR LIQUIDE GROUP COMPANY

Material Safety Data Sheet

OXYGEN GAS

PRODUCT NAME Oxygen Gas	EMERGENCY RESPONSE INFORMATION IN CASE OF EMERGENCY INVOLVING THIS MATERIAL, CALL DAY OR NIGHT............ 1-800-231-1366 OR CALL CHEMTREC AT 1-800-424-9300	
TELEPHONE (510) 977-6500		
LIQUID AIR CORPORATION CALIFORNIA PLAZA, SUITE 350 2121 N. CALIFORNIA BLVD. WALNUT CREEK, CALIFORNIA 94596	TRADE NAME AND SYNONYMS Oxygen	CAS NUMBER 7782-44-7
	CHEMICAL NAME AND SYNONYMS Oxygen	NFPA 704 NUMBER (HFR) 0 0 0 OXY
ISSUE DATE & REVISIONS Rev. Sept. 2, 1991 CORPORATE SAFETY DEPT.	FORMULA O_2 — MOLECULAR WEIGHT 31.999	CHEMICAL FAMILY Oxidizer

HEALTH HAZARD DATA

TIME WEIGHTED AVERAGE EXPOSURE LIMIT

None established (ACGIH, 1989-90). Oxygen is the "vital element" in the atmosphere in which we live and breathe (approximately 21 molar (volume) percent of the atmosphere). The minimum oxygen content in workplace air is 18% by volume under normal atmospheric pressure, equivalent to a partial pressure, pO_2 of 135 torr, (ACGIH 1989-90).

SYMPTOMS OF EXPOSURE

The primary route of entry is inhalation. **Acute health effects:** Adults can satisfactorily breathe pure oxygen for extended periods at 0.33 atm, or at 1 atm for several days at less than 5 hours a day. However, irritation to mucous membranes may occur when 100% oxygen is inhaled continuously for several hours. Chest pains and cough can result from breathing O_2 at 1 atm for 8 to 24 hours or 2 atm for 2 to 3 hours or from an atmosphere of 60% oxygen for several days. Breathing high concentrations greater than 75 (molar) percent by volume at atmospheric pressure for more than a few hours causes symptoms of hyperoxia (high oxygen exposure) with a variety of central nervous system effects. These symptoms include cramps, nausea, dizziness, hypothermia (low body temperature), ambylopia (diminished vision), nasal stuffiness, cough, sore throat, chest pain, respiratory difficulties, bradycardia (slow heart rate), fainting spells, and convulsions capable of leading to death.

Breathing oxygen at higher pressures increases the likelihood of adverse effects within a shorter time period. For additional data on hyperoxia (high oxygen exposure) as it relates to oxygen pressure and exposure duration, refer to L'Air Liquide's Encyclopedie des Gaz. **Chronic health effects:** None established. **Medical conditions generally aggravated by exposure:** See **NOTES TO PHYSICIAN**, below.

NOTES TO PHYSICIAN:

Supportive treatment should include immediate sedation, anti-convulsive therapy if needed, and rest. Animal studies suggest that the administration of certain drugs, including phenothiazine drugs and chloroquine, increases the susceptibility to toxicity from oxygen at high concentrations or pressures. Animal studies also indicate that vitamin E deficiency may increase susceptibility to oxygen toxicity. Airway obstruction during high oxygen tension may cause alveolar collapse following absorption of the oxygen. Similarly, occlusion of the eustachian tubes may cause retraction of the eardrum and obstruction of the paranasal sinuses may produce "vacuum-type" headache.

Newborn premature infants exposed to high oxygen concentrations may suffer delayed retinal damage which can progress to retinal detachment and blindness (retrolental fibroplasia). Retinal damage can also occur in adults exposed to 100% oxygen under greater than atmospheric pressure, particularly in individuals whose retinal circulation has been previously compromised.

All individuals exposed for long periods to oxygen at high pressure and all who exhibit overt oxygen toxicity should have ophthalmologic examinations.

TOXICOLOGICAL PROPERTIES

At normal concentration and pressure, oxygen poses no toxicity hazards. However, at elevated concentrations and pressures, oxygen may cause adverse effects of hyperoxia (high oxygen exposure) which leads to pneumonia. Concentrations between 25 and 75 molar percent present a risk of inflammation of organic matter in the body.

Listed as Carcinogen or Potential Carcinogen	National Toxicology Program	YES ☐ NO ☒	I.A.R.C. Monographs YES ☐ NO ☒	OSHA YES ☐ NO ☒

WARNING FOR MEDICAL OXYGEN U.S.P.: For oxygen deficiency in breathing persons or emergency resuscitation when used by personnel instructed in oxygen administration. For other medical applications, use only as directed by a licensed practitioner. Uninterrupted use of high concentrations of oxygen over a long duration, without monitoring its effect on oxygen content of arterial blood, may be harmful. Use only with pressure reducing equipment and apparatus designed for oxygen.

RECOMMENDED FIRST AID TREATMENT

PROMPT MEDICAL ATTENTION IS MANDATORY IN ALL CASES OF OVEREXPOSURE TO OXYGEN. RESCUE PERSONNEL SHOULD BE AWARE OF EXTREME FIRE HAZARD ASSOCIATED WITH OXYGEN-RICH ATMOSPHERES. REDUCE OXYGEN PRESSURES TO 1 ATMOSPHERE AND/OR MOVE VICTIM INTO FRESH AIR.

Conscious persons should be assisted to an uncontaminated area and breathe fresh air. They should be kept warm and quiet. The physician should be informed that the victim is experiencing (has experienced) hyperoxia (high oxygen exposure).

Unconscious persons should be moved to an uncontaminated area and given assisted respiration. When breathing has been restored, treatment should be as above. Continued treatment should be symptomatic and supportive.

HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES

Although not flammable itself, oxygen vigorously accelerates fire and combustion (burning). Contact with all flammable materials should be avoided. Some materials which are not flammable in air will burn in pure oxygen or oxygen-enriched atmospheres. Materials that burn in air can burn with explosive violence in a pure oxygen or oxygen-enriched atmosphere.

PHYSICAL DATA

BOILING POINT -297.35°F (-182.97°C)	LIQUID DENSITY AT BOILING POINT 71.23 lb/ft³ (1141 kg/m³); specific gravity = 1.14
VAPOR PRESSURE @ 70°F (21.1°C) above the critical temp. of -181.433°F (-118.574°C)	GAS DENSITY AT 70° F 1ATM .0828 lb/ft³ (1.326 kg/m³)
SOLUBILITY IN WATER @ 68°F (20°C) Bunsen coefficient = 0.0310; 3.16cm³ / 100g @ 25°C	FREEZING POINT -361.838°F (-218.799°C)
APPEARANCE AND ODOR Colorless, odorless and tasteless gas. Specific gravity @ 70°F (Air = 1.0) is 1.11.	

FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (METHOD USED)	AUTO IGNITION TEMPERATURE	FLAMMABLE LIMITS % BY VOLUME
Not Applicable	Not Applicable	Not Applicable

EXTINGUISHING MEDIA	ELECTRICAL CLASSIFICATION
Copious quantities of water for fires with oxygen as the oxidizer.	Nonhazardous

SPECIAL FIRE FIGHTING PROCEDURES

If possible, stop the flow of oxygen which is supporting the fire if you can do so without risk. Use media that are appropriate to the surrounding fire. Immediately cool fire-exposed container, standing at a safe distance as far away as possible and using a water spray. If feasible, remove oxygen containers from fire area. Containers may explode in the heat of fire. Though not flammable itself, oxygen vigorously supports combustion.

Materials that do not burn in air may burn in oxygen-enriched air (>23% oxygen). Some materials can even become spontaneously flammable in oxygen or oxygen-enriched air. Oxygen released in a fire situation greatly increases fire and explosion hazards. (Oxygen cylinders are equipped with safety devices to release O_2 at excessive temperature or pressure).

UNUSUAL FIRE AND EXPLOSION HAZARDS

High pressure oxidizing gas. Cylinder pressure can be 2,000 - 3,000 psi @ 70°F or up to 6,000 psi @ 70°F for ultra-high pressure cylinders. Vigorously accelerates combustion (burning). No smoking in cylinder area or while oxygen is in use. Keep oil and grease away. Keep oxygen cylinders away from flammables and combustibles.

REACTIVITY DATA

STABILITY		CONDITIONS TO AVOID
UNSTABLE		Oxygen is stable when kept isolated as a compressed gas in cylinders. This material is an oxidizing agent that vigorously accelerates combustion (burning, fire). Oxygen will undergo highly exothermic reactions or explosions with many materials. The greater the concentration of O_2 in contact with a fuel or reducing agent, the greater the violence of the reaction. Air contains 21 percent oxygen: reactivity with environmental materials is substantially increased at above 23 percent oxygen by volume.
STABLE	X	
INCOMPATIBILITY (MATERIALS TO AVOID): All flammable materials.		Oxygen reacts explosively with phosphine, hydrazine, hydrogen sulfide, ethers, alcohols, hydrocarbons, etc. Red-hot steel burns in an oxygen atmosphere. This material is incompatible with oils, grease, lubricants, asphalt, and flammable materials. Keep oxygen cylinders free of oil and/or grease.
HAZARDOUS DECOMPOSITION PRODUCTS: None		
HAZARDOUS POLYMERIZATION		CONDITIONS TO AVOID
MAY OCCUR		Not applicable
WILL NOT OCCUR	X	

SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

Evacuate all personnel from affected area. Use appropriate protective equipment (Refer to "SPECIAL PROTECTION INFORMATION" section). Provide optimum exhaust ventilation. If at all possible, shut off the source of the oxygen leak if you can do so without risk. Remove sources of heat, ignition and, if feasible, separate combustibles from the leak. Shut off all internal combustion engines within 50 feet of affected area. Small leaks in an oxygen system in an enclosed, unventilated area can build up a hazardous oxygen level. If leak is in user's equipment, be certain to purge piping with an inert gas prior to attempting repairs. SNOOP® solutions for oxygen service may be used to detect gaseous leaks. If leak is in container or container valve, contact the closest Liquid Air Corporation location.

WASTE DISPOSAL METHOD

Do not attempt to dispose of residual or unused quantities. Return in the shipping container tagged to indicate a defect, and properly labeled, with any valve outlet plugs or caps secured and valve protection cap in place to Liquid Air Corporation for proper disposal. For emergency disposal, contact the closest Liquid Air Corporation location.

SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (SPECIFY TYPE)
Not applicable

VENTILATION	LOCAL EXHAUST	SPECIAL
To prevent accumulation above 23 molar percent	To prevent accumulation above 23 molar percent	See page 4
	MECHANICAL (GEN.)	OTHER
	See page 4	See page 4

PROTECTIVE GLOVES
As required, any material

EYE PROTECTION
Safety goggles or glasses

OTHER PROTECTIVE EQUIPMENT
Safety shoes, safety shower

SPECIAL PRECAUTIONS*

SPECIAL LABELING INFORMATION

DOT Shipping Name:	Oxygen, compressed	DOT Hazard Class:	Nonflammable gas; Class 2, Division 2.2
DOT Shipping Label:	Oxidizer or Oxygen	I.D. No.:	UN 1072

SPECIAL HANDLING RECOMMENDATIONS

Use only in well-ventilated areas. Valve protection caps and valve outlet threaded plugs must remain in place unless cylinder is secured with valve outlet piped to use point. Do not drag, slide or roll cylinders. Use a suitable hand truck for cylinder movement. Use a pressure reducing regulator when connecting cylinder to lower pressure (<3,000 psig) piping or systems. Do not heat cylinder by any means to increase the discharge rate of product from the cylinder. Use a check valve or trap in the discharge line to prevent hazardous back flow into the cylinder. Close cylinder valve after each use and when cylinder is empty.

For additional handling recommendations see References on last page.

*Various Government agencies (i.e. Department of Transportation, Occupational Safety and Health Administration, Food and Drug Administration and others) may have specific regulations concerning the transportation, handling, storage or use of this product which may not be contained herein. The customer or user of this product should be familiar with these regulations.

LAC 05127 (9/2/91)

SPECIAL STORAGE RECOMMENDATIONS

Protect cylinders from physical damage. Store in clean, cool, dry, well-ventilated area away from heavily trafficked areas and emergency exits, away from combustibles and away from full or empty stored cylinders which contain flammable products. Do not allow the temperature where cylinders are stored to exceed 125°F (52°C). Cylinders should be stored upright and firmly secured to prevent falling or being knocked over. Full and empty cylinders should be segregated. Use a "first in - first out" inventory system to prevent full cylinders being stored for excessive periods of time.

For additional storage recommendations see Reference section on this page.

SPECIAL PACKAGING RECOMMENDATIONS

Carbon steels and low alloy steels are acceptable for use at lower pressures (less than 1,000 psig). For higher (to 2900 psig) pressure applications, use stainless steels, copper and its alloys, nickel and its alloys, brass, bronze, silicon alloys, Monel®, Inconel®, or beryllium. Lead and silver or lead and tin alloys are good gasketing materials. Teflon® and Kel-F® are the preferred nonmetal gaskets. CGA valve outlet for oxygen gas is CGA 540 (to 3,000 psig); CGA 870 for medical gas pin-indexed yoke connection.

Special Note: It should be recognized that the ignition temperature of metals and nonmetals in pure oxygen service decreases with increasing oxygen pressure. For additional information refer to L'Air Liquide's Encyclopedie des Gaz. It is also important to avoid high gas velocities which tend to increase the possibility of ignition by friction, impact and static discharge. Refer to Compressed Gas Association Pamphlet G-4.4 for velocity limits.

OTHER RECOMMENDATIONS OR PRECAUTIONS

Oxygen ***must not*** be used as a substitute for compressed air in pneumatic equipment since this type generally contains flammable lubricants. Do not use oil or grease to lubricate the valve on an oxygen cylinder or regulator. Equipment to contain oxygen must be "cleaned for oxygen service" and rated for cylinder pressure. See Compressed Gas Association Pamphlets G-4 and G-4.1. Open and close cylinder valve slowly. Ground equipment to eliminate buildup of static charge. Keep sparks, flame and lighted cigarettes away from cylinders and under no circumstances allow a torch flame to come in contact with cylinders, valves, or pressure relief devices. Should the valve outlet of a cylinder become clogged with ice, thaw with warm -- not boiling -- water. Compressed gas cylinders should not be refilled except by qualified suppliers of compressed gases. Shipment of a compressed gas cylinder which has not been filled by the owner or with his (written) consent is a violation of Federal Law (49CFR). **WHEN USED IN WELDING AND CUTTING:** Read and understand the manufacturer's instructions and the precautionary label on the product. See American National Standard Z49.1 "Safety in Welding and Cutting" published by the American Welding Society, P.O. Box 351040, Miami, Florida 33135 and OSHA Publication 2206 (29CFR1910), U.S. Government Printing Office, Washington, D.C. 20402 for more detail. **NOTE:** Suitability for use as a component in underwater breathing gas mixtures is to be determined by or under the supervision of personnel experienced in the use of underwater breathing gas mixtures and familiar with the effects, methods, frequency and duration of use, hazards, side effects and precautions to be taken.

Use in accordance with Material Safety Data Sheet.

SPECIAL PROTECTION INFORMATION (SPECIAL, MECHANICAL, OTHER; CONTINUED):

Where oxygen may be released, provide adequate ventilation to prevent excessive oxygen enrichment of the workplace atmosphere (holding at <23% O_2 by volume is recommended for fire safety). Personnel who have been exposed to high concentrations of oxygen should stay in a well-ventilated or open area for 30 minutes before going into a confined space or near an ignition source.

Safety shoes and safety glasses are recommended when handling cylinders of compressed gas. Clothing that has been overexposed or contaminated with oxygen should be removed and considered unsafe (highly flammable) to wear for at least 30 minutes. If oxygen-enriched clothing catches fire, extinguish the flame under a safety shower; a fire blanket may not be effective in this situation. Use a continuous water spray to soak the clothing of a rescuer who must operate in an oxygen-enriched fire area. Contact lenses pose a special hazard; soft lenses may absorb irritants, and all lenses concentrate them.

REFERENCES

1. L'Air Liquide Encyclopedie des Gaz. Contact Liquid Air Corporation Corporate Safety Department, 510-977-6500.

2. Compressed Gas Association (CGA) Pamphlet P-1 "Safe Handling of Compressed Gases in Containers"; G-4 "Oxygen"; G-4.1 "Cleaning Equipment for Oxygen Service"; G-4.4 "Industrial Practices for Gaseous Oxygen Transmission and Distribution Piping Systems".

CGA telephone number is 703-979-0900.

LIQUID AIR CORPORATION
INDUSTRIAL GASES DIVISION

Material Safety Data Sheet

	PRODUCT NAME Acetylene	
	TELEPHONE (415) 977-6500 EMERGENCY RESPONSE INFORMATION ON PAGE 2	
LIQUID AIR CORPORATION INDUSTRIAL GASES DIVISION One California Plaza, Suite 350 2121 N. California Blvd. Walnut Creek, California 94596	TRADE NAME AND SYNONYMS Acetylene, Ethyne	CAS Number: 74-86-2
	CHEMICAL NAME AND SYNONYMS Acetylene, Ethyne	
ISSUE DATE AND REVISIONS: OCTOBER 1, 1985 CORPORATE SAFETY DEPT.	FORMULA: C_2H_2 — MOLECULAR WEIGHT: 26.0	CHEMICAL FAMILY Alkyne

HEALTH HAZARD DATA

TIME WEIGHTED AVERAGE EXPOSURE LIMIT Acetylene is defined as a simple asphyxiant. Oxygen levels should be maintained at greater than 18 molar percent at normal atmospheric pressure which is equivalent to a partial pressure of 135 mm Hg. (ACGIH, 1984-85)

SYMPTOMS OF EXPOSURE

Inhalation: Low concentrations (10-20% in air) cause symptoms similar to that of being intoxicated. Higher concentrations so as to exclude an adequate supply of oxygen to the lungs cause unconsciousness.

TOXICOLOGICAL PROPERTIES

As a narcotic gas or intoxicant causes hypercapnia (an excessive amount of carbon dioxide in the blood). Repeated exposures to tolerable levels has not shown deleterious effects. The major property is the exclusion of an adequate supply of oxygen to the lungs.

Listed as Carcinogen or Potential Carcinogen	National Toxicology Program	I.A.R.C. Monographs	OSHA
Yes	☐	☐	☐
No	☒	☒	☒

RECOMMENDED FIRST AID TREATMENT

PROMPT MEDICAL ATTENTION IS MANDATORY IN ALL CASES OF OVEREXPOSURE TO ACETYLENE. RESCUE PERSONNEL SHOULD BE EQUIPPED WITH SELF-CONTAINED BREATHING APPARATUS AND BE COGNIZANT OF EXTREME FIRE AND EXPLOSION HAZARD.

Inhalation: Conscious persons should be assisted to an uncontaminated area and inhale fresh air. Quick removal from the contaminated area is most important. Unconscious persons should be moved to an uncontaminated area, given mouth-to-mouth resuscitation and supplemental oxygen. Medical assistance should be sought immediately.

HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES

Flammable over an extremely wide range in air. Explosive reactions may occur on ignition. Reacts explosively with halogens and halogenated compounds.

PHYSICAL DATA

BOILING POINT Sublimation point = -118.8°F (-83.8°C)	**LIQUID DENSITY AT BOILING POINT** See last page
VAPOR PRESSURE 645 psia (4450 kPa) @ 70°F (21.1°C)	**GAS DENSITY AT 70°F 1 atm** @ 60°F (15.5°C) = .0691 lb/ft^3 (1.107 kg/m^3)
SOLUBILITY IN WATER @ 68°F (20°C) Bunsen coefficient = 1.047	**FREEZING POINT** Triple point = -113°F (-80.55°C)

APPEARANCE AND ODOR Pure acetylene is a colorless gas with an ethereal odor. Commerical (carbide) acetylene has a distinctive garlic-like odor. Spec. Grav. (Air=1.0) = 0.91 @ 70°F

FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (METHOD USED) Gas	**AUTO IGNITION TEMPERATURE** 565°F (296°C)	**FLAMMABLE LIMITS % BY VOLUME** LEL=2.2; UEL=80-85* *See note on last page.

EXTINGUISHING MEDIA Carbon dioxide; dry chemical

ELECTRICAL CLASSIFICATION Class 1, Group A

SPECIAL FIRE FIGHTING PROCEDURES
If possible, stop flow of escaping gas. Use water spray to cool surrounding containers. Keep personnel away since heated or burning cylinders can rupture violently.

UNUSUAL FIRE AND EXPLOSION HAZARDS
GASEOUS ACETYLENE IS SPONTANEOUSLY COMBUSTIBLE IN AIR AT PRESSURES ABOVE 30 PSIA (207 kPa).

(Continued on last page.)

REACTIVITY DATA

STABILITY		CONDITIONS TO AVOID
Unstable	X	Do not allow the free gas (outside of cylinder) to exceed 30 psia. (Continued on last page.)
Stable		

INCOMPATIBILITY (Materials to avoid) Oxygen and other oxidizers including all of the halogens and halogen compounds. Forms explosive acetylide compounds with (Continued on last page.)

HAZARDOUS DECOMPOSITION PRODUCTS
Carbon and hydrogen

HAZARDOUS POLYMERIZATION		CONDITIONS TO AVOID
May Occur		
Will Not Occur	X	

SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED
Evacuate all personnel from affected area. Use appropriate protective equipment. If leak is in user's equipment, be certain to purge piping with an inert gas prior to attempting repairs. If leak is in container or container valve, contact the closest Liquid Air Corporation location.

WASTE DISPOSAL METHOD
Do not attempt to dispose of waste or unused quantities. Return in the shipping container properly labeled, with any valve outlet plugs or caps secured and valve protection cap in place to Liquid Air Corporation for proper disposal. For emergency disposal, contact the closest Liquid Air Corporation location.

EMERGENCY RESPONSE INFORMATION
IN CASE OF EMERGENCY INVOLVING THIS MATERIAL, CALL DAY OR NIGHT (800) 231-1366
OR CALL CHEMTREC AT (800) 424-9300

SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (Specify type) Positive pressure air line with mask or self-contained breathing apparatus should be available for emergency use.

VENTILATION		SPECIAL
Hood with forced ventilation	**LOCAL EXHAUST** To prevent accumulation above the LEL.	
	MECHANICAL (Gen.) In accordance with electrical codes	**OTHER**

PROTECTIVE GLOVES
PVC or rubber in laboratory; as required for cutting & welding.

EYE PROTECTION
Safety goggles or glasses

OTHER PROTECTIVE EQUIPMENT
Safety shoes, safety shower

SPECIAL PRECAUTIONS*

SPECIAL LABELING INFORMATION

DOT Shipping Name:	Acetylene	DOT Hazard Class:	Flammable gas
DOT Shipping Label:	Flammable gas	ID No.:	UN 1001

SPECIAL HANDLING RECOMMENDATIONS

Use only in well-ventilated areas. Valve protection caps must remain in place unless container is secured with valve outlet piped to use point. Do not drag, slide or roll cylinders. Use a suitable hand truck for cylinder movement. Use a pressure reducing regulator when removing gas from the cylinder. DO NOT ALLOW THE FREE GAS TO EXCEED 30 PSIA (207 kPa) @ 70°F (21.1°C). Do not heat cylinder by any means to increase the discharge rate of product from the cylinder. Use a check valve or trap in the discharge line to prevent hazardous back flow into the cylinder.

For additional handling recommendations consult L'Air Liquide's Encyclopedia de Gaz or Compressed Gas Association Pamphlet P-1.

SPECIAL STORAGE RECOMMENDATIONS

Protect cylinders from physical damage. Store in cool, dry, well-ventilated area of non-combustible construction away from heavily trafficked areas and emergency exits. Do not allow the temperature where cylinders are stored to exceed 130F (54C). Cylinders must be stored upright and firmly secured to prevent falling or being knocked over. Full and empty cylinders should be segregated. Use a "first in-first out" inventory system to prevent full cylinders being stored for excessive periods of time. Post "No Smoking or Open Flames" signs in the storage or use area. There should be no sources of ignition in the storage or use area.

For additional storage recommendations consult L'Air Liquide's Encyclopedia de Gaz or Compressed Gas Association Pamphlet P-1.

SPECIAL PACKAGING RECOMMENDATIONS

Since acetylene will explode or combust if its pressure exceeds 30 psia (207 kPa) it is shipped dissolved in acetone or dimethylformamide which is dispersed in a porous mass within the cylinder. Follow Liquid Air Corporation's instructions for the maximum withdrawal rate for each size cylinder so that solvent is not withdrawn with the acetylene.

Most metals, except silver, copper, mercury or brasses with more than 66% copper, are compatible (non corrosive) with acetylene.

OTHER RECOMMENDATIONS OR PRECAUTIONS

Earth-ground and bond all lines and equipment associated with the acetylene system. Electrical equipment should be non-sparking or explosion proof. Compressed gas cylinders should not be refilled except by qualified producers of compressed gases. Shipment of a compressed gas cylinder which has not been filled by the owner or with his (written) consent is a violation of Federal Law (49CFR).

Transport cylinders in well-ventilated vehicles, upright and suitably restrained to prevent movement. (Continued on last page).

*Various Government agencies (i.e., Department of Transportation, Occupational Safety and Health Administration, Food and Drug Administration and others) may have specific regulations concerning the transportation, handling, storage or use of this product which may not be contained herein. The customer or user of this product should be familiar with these regulations.

ADDITIONAL DATA

LIQUID DENSITY AT BOILING POINT: (Continued)

Solid density @ sublimation point = 45.51 lb/ft^3 (729 kg/m^3)

FLAMMABLE LIMITS % BY VOLUME: (Continued)

Note: Pure acetylene can ignite by decomposition above 30 psia (207 kPa); therefore, the UEL is 100% if the ignition source is of sufficient intensity.

UNUSUAL FIRE AND EXPLOSION HAZARDS: (Continued)

It requires a very low ignition energy so that fires which have been extinguished without stopping the flow of gas can easily reignite with possible explosive force. Acetylene has a density very similar to that of air so when leaking it does not readily dissipate.

CONDITIONS TO AVOID: (Continued)

Cylinders should not be exposed to sudden shock or sources of heat.

INCOMPATIBILITY (MATERIALS TO AVOID): (Continued)

copper, mercury, silver, brasses containing more than 66% copper and brazing materials containing silver or copper.

OTHER RECOMMENDATIONS OR PRECAUTIONS (Continued)

Possible increasing fire intensity and explosion hazard if cylinders are so piled or stacked that burning gas escaping from a melted fuse plug (pressure relief device) plays on other cylinders.

FD

U.S. DEPARTMENT OF LABOR
Occupational Safety and Health Administration

Form Approved
OMB No. 44-R1387

MATERIAL SAFETY DATA SHEET

Rev. 10/81

Required under USDL Safety and Health Regulations for Ship Repairing, Shipbuilding, and Shipbreaking (29 CFR 1915, 1916, 1917)

SECTION I

MANUFACTURER'S NAME: Eagle-Picher Industries, Inc.	EMERGENCY TELEPHONE NO.: 513 721-7010
ADDRESS (Number, Street, City, State, and ZIP Code): 580 Building, P.O. Box 779, Cincinnati, Ohio 45201	
CHEMICAL NAME AND SYNONYMS: Diatomaceous earth	TRADE NAME AND SYNONYMS: Floor-Dry
CHEMICAL FAMILY: Amorphous or opaline silica	FORMULA: Predominantly SiO_2 (Amorphous)

SECTION II - HAZARDOUS INGREDIENTS

PAINTS, PRESERVATIVES, & SOLVENTS		%	TLV (Units)	ALLOYS AND METALLIC COATINGS		%	TLV (Units)
PIGMENTS	Does not apply			BASE METAL	Does not apply		
CATALYST	" " "			ALLOYS	" " "		
VEHICLE	" " "			METALLIC COATINGS	" " "		
SOLVENTS	" " "			FILLER METAL PLUS COATING OR CORE FLUX	" " "		
ADDITIVES	" " "			OTHERS	" " "		
OTHERS	" " "						

HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES	%	TLV (Units)
See Section V		

SECTION III - PHYSICAL DATA

BOILING POINT (°F.)	4050°F.	SPECIFIC GRAVITY (H_2O=1)	2.2
VAPOR PRESSURE (mm Hg.)	?	PERCENT, VOLATILE BY VOLUME (%)	0.0
VAPOR DENSITY (AIR=1)	?	EVAPORATION RATE (______=1)	0.0
SOLUBILITY IN WATER	0.5-2%		
APPEARANCE AND ODOR	Granular material - no odor		

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (Method used): None	FLAMMABLE LIMITS: Will not burn	Lel	Uel

EXTINGUISHING MEDIA
Does not apply

SPECIAL FIRE FIGHTING PROCEDURES
None required, will not burn

UNUSUAL FIRE AND EXPLOSION HAZARDS
None

(Continued on reverse side)

SECTION V - HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE	See General Industry Standards (OSHA) Sec. 1910.1000 Table Z-3
EFFECTS OF OVEREXPOSURE	Inhalation of quantities of dust in excess of TLV recommended by OSHA over an extended number of years may produce pulmonary impairment.
EMERGENCY AND FIRST AID PROCEDURES	

SECTION VI - REACTIVITY DATA

STABILITY	UNSTABLE		CONDITIONS TO AVOID
	STABLE	X	
INCOMPATABILITY *(Materials to avoid)*	Hydrofluoric Acid		
HAZARDOUS DECOMPOSITION PRODUCTS	None		
HAZARDOUS POLYMERIZATION	MAY OCCUR		CONDITIONS TO AVOID
	WILL NOT OCCUR	X	

SECTION VII - SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

Non Toxic. Vacuum clean spillage, wet sweep or wash away

WASTE DISPOSAL METHOD

Non-Biodegradable - use solid waste disposal common to land fill type operation or similar disposal.

SECTION VIII - SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION *(Specify type)* NIOSH or MHSA (formerly MESA) approved respirators.		
VENTILATION	LOCAL EXHAUST: Control within TLV	SPECIAL
	MECHANICAL *(General)*	OTHER
PROTECTIVE GLOVES: Normally not necessary	EYE PROTECTION: Normally not necessary	
OTHER PROTECTIVE EQUIPMENT: Normally not necessary		

SECTION IX - SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING

Maintain good houskeeping practices. Avoid creating dust.

OTHER PRECAUTIONS

he date hereof, Eagle-Picher Industries, Inc. ... no warranty in respect thereto and
disclaims all liability from reliance thereon.

MATERIAL SAFETY DATA SHEET

EAGLE-PICHER INDUSTRIES, INCORPORATED
MINERALS DIVISION
PO BOX 12130, RENO, NEVADA, 89510
702-322-3331

#7601

DATE ISSUED:11/18/85 DATE REVISED: -

1. IDENTIFICATION

PRODUCT NAME:FLOOR DRY; SUPER FINE, DIALOAM, CELATOM MP GRADES
CHEMICAL FAMILY:AMORPHOUS SILICA CHEMICAL FORMULA:O2Si
CAS #:7631-86-9 W% 100% V% 100%
CHEMICAL NAME:DIATOMACEOUS EARTH, CALCINED
LISTED AS A CARCINOGEN IN NTP, IARC, OR OSHA 1910(2) - NO
HAZARD MATERIAL DESCRIPTION,PROPER SHIPPING NAME, HAZARD ID NO.
(49CFR172.101) - DOES NOT APPLY
ADDITIONAL HAZARD CLASS - DOES NOT APPLY

2. PHYSICAL DATA

BOILING POINT: 4050 DEG. F
VAPOR PRESSURE:NOT APPLICABLE
VAPOR DENSITY:NOT APPLICABLE
EVAPORATION RATE:NOT APPLICABLE
% VOLATILE:NOT APPLICABLE
SOLUBILITY IN H2O: < 2%
SPECIFIC GRAVITY: 2.2
% SOLID BY WEIGHT:100%
pH: (10% SLURRY) 6.0-8.0
APPEARANCE: ODORLESS GRANULAR PDODUCT, BUFF TO OFF-WHITE

3. FIRE AND EXPLOSION HAZARD DATA

FLASH POINT:NOT APPLICABLE
FLAMMABLE LIMITS: LEL - NOT APPLICABLE UEL - NOT APPLICABLE
EXTINGUISHING MEDIA:NOT APPLICABLE
SPECIAL FIRE FIGHTING PROCEDURES:NOT APPLICABLE
UNUSUAL FIRE AND EXPLOSION HAZARDS:NOT APPLICABLE

4. HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE: 1.25 MG./ CU M.
PERMISSIBLE EXPOSURE LIMIT: 1.25 MG./ CU M.
EFFECTS OF OVEREXPOSURE-CONDITIONS TO AVOID:INHALATION OF DUST IN EXCESS OF TLV RECOMMENDED BY ACGIH OVER AN EXTENDED NUMBER OF YEARS MAY PRODUCE PNEUMOCONIOSIS.
PRIMARY ROUTES OF ENTRY: INHALATION (X), SKIN CONTACT ( ),OTHER()
EMERGENCY AND FIRST AID PROCEDURES:NONE REQUIRED
HAZARDOUS INGREDIENTS: ANALYSES BY X-RAY DIFFRACTION HAVE SHOWN THE PRODUCTS LISTED ON THIS SHEET TO CONTAIN BETWEEN 0% AND 2% CRYSTALLINE SILICA AS CRISTOBALITE WITH AN AVERAGE CONCENTRATION OF 0.8%. REFER TO THE ATTACHED FOR AN EXPLANATION OF TLV AND PEL.

5. REACTIVITY DATA

STABILITY: STABLE (X) UNSTABLE ( )
CONDITIONS TO AVOID:NOT APPLICABLE
INCOMPATIBILITY (materials to avoid): HYDROFLUORIC ACID, HYDROGENATED VEGATABLE OILS
HAZARDOUS DECOMPOSITION PRODUCTS:NOT APPLICABLE
HAZARDOUS POLYMERIZATION: MAY OCCUR ( ) , WILL NOT OCCUR (X)
CONDITIONS TO AVOID:NOT APPLICABLE

6. SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED: NONTOXIC, VACUUM CLEAN SPILLAGE, WET SWEEP OR WASH AWAY

WASTE DISPOSAL METHOD:NON-BIODEGRADABLE, USE SOLID WASTE DISPOSAL COMMON TO LANDFILL TYPE OPERATIONS OR SIMILAR DISPOSAL OR IN SLURRY TO SUMPS.

7. SPECIAL PROTECTION INFORMATION

RESIRATORY PROTECTION: BUREAU OF MINES OR NIOSH APPROVED RESPIRATORS FOR PROTECTION AGAINST PNEUMOCONIOSIS-PRODUCING DUST RECOMMENDED WHEN CONCENTRATIONS OF DUST EXCEED RECOMMENDED TLV.
VENTILATION:LOCAL - CONTROL WITHIN TLV
PROTECTIVE GLOVES: NOT NORMALLY NECESSARY
EYE PROTECTION:NOT NORMALLY NECESSARY
OTHER PROTECTIVE EQUIPMENT: NOT NORMALLY NECESSARY

8. SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING: MAINTAIN GOOD HOUSEKEEPING PRACTICES - AVOID CREATING DUST
OTHER PRECAUTIONS: SEE CAUTION LABEL ON BAG

NAME:R.W. PIEKARZ, PE
SIGNATURE: R.W. Piekarz
TITLE:VP ENGRG & ENVIR
DATE:NOVEMBER 18, 1985

NOTICE: WHILE THE INFORMATION AND RECOMMENDATIONS SET FORTH HEREIN ARE BELIEVED TO BE ACCURATE AS OF THE DATE HEREOF, EAGLE-PICHER INDUSTRIES, INC. MAKES NO WARRANTY IN RESPECT THERETO AND DISCLAIMS ALL LIABILITY FROM RELIANCE THEREON. (AS OF THIS DATE THERE ARE NO UNIVERSALLY ACCEPTABLE STANDARDS FOR CRISTOBALITE.)

COMPUTATION OF TLV

TABLE Z-3: An employee's exposure to any material listed in Table Z-3, in any 8-hour work shift of a 40-hour work week, shall not exceed the 8-hour time weighted average limit (TLV) given for that material in the table.

TABLE Z-3 - MINERALS DUSTS **

SUBSTANCE	Mppcf	Mg/CU. M.
SILICA:		
CRYSTALLINE:		
QUARTZ (Respirable)	$\frac{250}{\%SiO_2+5}$	$\frac{10\ Mg/CU.\ M.^*}{\%SiO_2 + 2}$
QUARTZ (Total Dust)		$\frac{30\ Mg/CU.\ M.}{\%SiO_2 + 3}$
CRISTOBALITE: Use 1/2 the value calculated from the count or mass formulae for quartz.		
TRIDYMITE: Use 1/2 the value calculated from the formulae for quartz.		
AMORPHOUS DIATOMACEOUS EARTH	20 Mppcf	1.5 Mg/CU.M#

* The percentage of Cyrstalline Silica in the formula is the amount determined from airborne samples except in those instances in which other methods have been shown to be applicable.

\# From 1985-86 ACGIH Threshold limit values, Table 1, equivalent TLV's in Mppcf and Mg./CU.M. (respirable mass) for mineral dusts.

** Table Z-3 - Minerals Dusts - Code of Federal Regulations, Title 29, Chapter XVII, Part 1910, Subpart Z; revised as of July 1, 1979, etc, etc., amended by 48 FR 53280, November 25, 1983.

PEL computation based on the same formulae.

EAGLE PICHER CELATOM

Technical Data

Celatom Products

Minerals Division

CELATOM MP-78

EAGLE-PICHER INDUSTRIES, INC • 580 Walnut Street, P.O. Box 779, Cincinnati, Ohio 45201 • Processing Plants: Clark & Colado, Nevada

CELATOM MP-78

Celatom MP-78 is a calcined diatomaceous earth processed for use as a light weight general fill, absorbing compound, and may be incorporated in products that require an optimum ratio between light density and high melting point.

It is essentially pure amorphous silica and as such may be used by those requiring a silica source.

Physical Properties (Typical)

Screen Analysis (Tyler)	
+20 Mesh	15%
-20 +28 Mesh	28%
-28 +65 Mesh	48%
-65 Mesh	9%
Apparent Dry Density (lbs./cu.ft.) (tapped)	25.0
Moisture (24 Hr. Oven Dry Method)	0.1%
Oil Absorption (Gardner-Coleman) (lbs./100 lbs.)	101.7
pH	7.0
Crushing Strength (.125" comp./1' column) (lbs./sq.in.)	221
Particles per Pound	16.56 million
Color	Light Tan
Structure	Predominantly amorphous diatomaceous silica

Chemical Analysis (Approximate)

Silica (SiO_2)	90.0%
Alumina (Al_2O_3)	6.5%
Iron Oxide (Fe_2O_3)	2.3%
Lime (CaO)	0.2%
Magnesia (MgO)	0.3%
Other Oxides	0.3%
Ignition Loss (In addition to Moisture at 105°)	0.4%

7/79

The high purity of Eagle-Picher's Celatom deposits in Storey and Pershing Counties, Nevada, their proximity to the surface, ... exceedingly dependable source of diatomaceous silica. Our flexible milling, classifying, calcining and flux-calcining facilities for producing the wide variety of grades of Celatom are

ATTACHMENT B

SUBCONTRACTOR CERTIFICATION

SUBCONTRACTOR CERTIFICATION

I, ______________________________ as an agent of ______________________________, do hereby certify the following employees have successfully completed a 40-hour training course, which complies with the provisions of 29 C.F.R. Part 1910.120, and respiratory protection training, which complies with 29 C.F.R. Part 1910.134. Each employee has successfully completed a medical examination, which complies with the above regulations.

Individual copies of certification of successful completion of the required training and medical examination are attached for each employee.

______________________	______________________	______________________
Signature	Title	Date

ATTACHMENT C

ACCIDENT/INJURY INVESTIGATION REPORTS

Accident/Injury/Near Miss Checklist

ᴺame of Person(s): ______________________________

.te of Incident: ____________________ Time: ____________________

Exact location of incident: ____________________

Job Title: ____________________ Job Number: ____________________

Supervisor : ____________________ ____________________

Printed Name Signature

Site Supervisor's Accident/Injury/Near Miss Checklist		
Step	**Action/Requirement**	**Date/Time** (24 hr clock)
1	Perform first aid/CPR, as appropriate, and get injured/ill to medical care (or summon care) immediately if required; summon assistance	
2	Isolate and protect scene of accident (non-automobile)	
3	Report incident by phone to Project Manager and Program H&S Manager immediately after situation is under control.	
4	Complete appropriate form(s)	
5	Perform Accident/Incident Investigation as soon as possible and complete accident investigation report.	
6	Submit accident investigation report to DOE-NV	
7	Turn this form in to Program Health and Safety Manager	

NOTE: Employees are required to report all injuries, illnesses, accidents, and near misses.

APPENDIX C

RISK ANALYSIS
FOR THE PROJECT CHARIOT SITE

Executive Summary

An analysis of the risks at the Project Chariot mound site was conducted to identify contaminants of potential concern and to establish the remediation clean-up level. The five major sections of the risk analysis consist of: evaluating the source and extent of contamination, assessing the potential exposure pathways, characterizing the risks from the contamination, modeling to verify exposures with the risk-based results, and establishing a clean-up level based on the risk analysis and exposure modeling.

Source and Extent of Contamination - The radioactive tracer studies performed in 1962 are the sources of the contamination. Soil from near the Sedan crater and individual isotopes of cesium, strontium, and iodine were imported and introduced to the site. A total quantity of 9.6×10^8 becquerels (Bq) (26 millicuries [mCi]) of material was introduced. Cesium-137 (Cs-137) is the only significant isotope that remains when the radioactive decay of the materials over the last 30 years is considered. The concentration of Cs-137 remaining in the lower portion of the mound was calculated to be 1.1 becquerels per gram (Bq/g) (30 picocuries per gram [pCi/g]) of soil.

Potential Exposure Pathways - Pathways of potential radiological risks to humans from the Project Chariot Site were identified as direct ingestion and external radiation exposure.

Risk Characterization - The total risk from exposure to the radioactive materials at the site was calculated utilizing the U.S. Environmental Protection Agency's (EPA) Human Health Evaluation Manual as guidance. The scenario that was utilized in the risk analysis simulated that the cover dirt had been removed and that only the actual 45 cubic meters (m^3) (1,600 cubic feet [ft^3]) of tracer study soils remained. The Cs-137 that remained was considered to be distributed homogeneously throughout these soils at the calculated level of 1.1 Bq/g (30 pCi/g). Humans were limited to being in the area for only 10 percent of the year due to the remote nature of the site. The results of the analysis indicates that a risk of 2×10^{-4} of developing cancer over a person's lifetime currently exists if the soils were to be left in place without the cover dirt.

A preliminary remediation goal for Cs-137 was then calculated utilizing the same techniques. The results were a remediation goal of 0.7 Bq/g (20 pCi/g) based on an acceptable risk of 1×10^{-4} of developing cancer over a person's lifetime.

Site Modeling - Modeling of the site conditions was then performed to calculate the exposure levels to the public. The model utilized an uncovered mound of dirt (as described above) and a Cs-137 concentration (after remediation) of 0.4 Bq/g (10 pCi/g). This concentration was chosen to incorporate a reduction of exposure by a factor of 2 over the preliminary remediation goal of 0.7 Bq/g (20 pCi/g) calculated in the risk assessment (in accordance with the principles of "as low as reasonably achievable" [ALARA]). The results of the modeling indicate that a person who resided on top of the mound (after the fill cover was removed) for 10 percent of the year would receive an additional 3 millirems per year (mrem/yr) of exposure above background. These results are significantly below the DOE limits for exposure to the general public of 100 mrem/yr.

Remediation Clean-Up Level - A clean-up level of 0.4 Bq/g (10 pCi/g) for Cs-137 was identified for this remediation effort.

C.1.0 Introduction

An analysis of the risks at the Project Chariot mound site was necessary to:

- establish what radionuclides are of concern at the site
- develop a remediation clean-up level to be used in the cleanup.

C.1.1 Regulatory Guidelines

The risk analysis was performed using guidance from both the U.S. Department of Energy's (DOE) requirements concerning exposure to the general public and the Environmental Protection Agency's (EPA) guidelines for risk analysis at Superfund Sites.

The controlling requirement in the risk analysis was DOE's requirement for ensuring that the exposure to the general public from the site is kept "as low as reasonably achievable" (ALARA), with exposure to be less than 100 millirems per year (mrem/yr) to an individual. Cleanup goals were identified that would meet these DOE requirements.

The exposure-based remedial action goals were verified to ensure that they were comparable with EPA's guidance for evaluating human health. The DOE requirements are the principle requirements that are applicable to the site; however, because the radioactive tracer soils are being cleaned up under the auspices of the Atomic Energy Act and the site is not a Superfund Site, EPA's guidance for Superfund sites was utilized for comparative purposes as a best engineering practice.

C.1.2 General Layout

The five major sections of the risk analysis consist of:

- evaluating the source and extent of contamination
- assessing the potential exposure mechanisms
- characterizing the risks from the contamination
- exposure modeling
- establishing cleanup levels.

C.2.0 Source and Extent of Contamination

Identification of contaminants and the nature and extent of the contamination is the first step in assessing risks from a site.

C.2.1 Source of the Contamination

The radioactive tracer studies performed by the United States Geological Survey (USGS) in 1962 are the sources of the contamination at the Project Chariot Site. The intent of the experiment was to quantify the methods of transport of radionuclides that would be introduced into the environment and the food chain if the Project Chariot detonations were to take place. Modeling of the process had been performed, but it was thought that small scale testing was necessary due to the uncertainties associated with the tundra environment.

The actual experiment attempted to meet these needs by introducing known quantities of radionuclides as surface contamination (similar to fallout) into controlled portions of the environment. The radionuclides that were utilized were of two types:

- Chemical compounds of isotopes of Cesium-137 (Cs-137), Iodine-131 (I-131), and Strontium-85 (Sr-85)(in the form of CsCl, NaI, and $Sr[NO_3]_2$) that had been introduced into sandy soil at the Denver Laboratory of the USGS.
- Soil that was collected from the vicinity of the Sedan Crater at the Nevada Test Site (NTS).

The amount of these materials was intended to simulate the anticipated concentrations of radioactive materials that would occur in the area due to fallout from the nuclear excavation. The materials were transported from the lower 48 states in a briefcase and then utilized in the tracer studies. After the experiment was complete, the soils from each plot were dug up, placed in drums, and then the drums were emptied into a single pile to composite the materials.

C.2.2 Individual Isotopes

The individual isotopes that were introduced are shown in Table C-1. This table describes the amount of material that was originally brought to the site and shows the amount that would be remaining in 1993, after taking into account the decay of radioactive material over

Table C-1
Individual Radionuclides Introduced in Tracer Studies

Radionuclide	Amount Introduced		Half-life (Years)	Amount Remaining in 1993		Concentration in Soil	
	(Bq)	(pCi)		(Bq)	(pCi)	(Bq/g)	(pCi/g)
Cesium-137	$2x10^8$	6×10^9	30.2	$1x10^8$	3×10^9	1.1	30
Iodine-131	$2x10^8$	5×10^9	0.02	0	0 (a)	0	0
Strontium-85	$2x10^8$	5×10^9	0.2	0	0 (b)	0	0

Explanation of Columns in Table C-1

Amount Introduced - The amount (in becquerels [Bq] and in picocuries [pCi]) of each type of isotope that was introduced to the site during the 1962 radiological tracer studies.

Half-life - Period of time for one half of the radioactive activity to decay (in years).

Amount Remaining in 1993 - The amount (in Bq and pCi) of each isotope that was calculated to still exist after accounting for 30 years of decay.

Concentration in Soil - The concentration (in Bq/g and pCi/g of soil) of each isotope that remains in the mound soil in 1993. Based on distributing the isotope homogeneously in 45 cubic meters (m^3) (1,600 cubic feet [ft^3]) of soil in 1962.

Notes for Table C-1

(a) The half-life of I-131 is 8.04 days (or 0.022 years). Approximately 1,250 half-lives have passed over the course of 30 years. The amount of material is less than 1×10^{-100} percent of what existed in 1962 and this isotope no longer exists at detectable levels.

(b) The half-life of Sr-85 is 64.8 days (or 0.177 years). Over 150 half-lives have passed over the course of 30 years. The amount of material is less than 1×10^{-50} percent of what existed in 1962 and this isotope no longer exists at detectable levels.

30 years. The only significant contaminant that remains is the Cs-137 at a concentration of 1.1 Bq/g (30 pCi/g) of soil. The Sr-85 has decayed for 150 half-lives and no longer exists at detectable levels. The I-131 has decayed for 1,250 half-lives and also does not exist at detectable levels.

C.2.3 Sedan Fallout

The radioactive tracer experiments also used 7,900 grams (g) (17.4 pounds [lb]) of soil from near the Sedan Crater at the NTS. The activity of the soil was estimated in 1962 to contain 4×10^8 Bq (10 millicuries [mCi]). Due to the uncertainties of the isotopes present in the original soil, two samples of soil were taken from near the Sedan Crater in late 1992. Results of the analysis of these samples and corresponding current concentrations in the mound are presented in Table C-2. The Cs-137 that remains from the Sedan soil is a negligible amount compared to the 1.1 Bq/g (30 pCi/g) from the individual isotope studies (see above). The other isotopes are below detectable levels, and gross beta and alpha analyses will be utilized to screen for unexpectedly high concentrations of these and other isotopes.

C.2.4 Overall Extent of Existing Contamination

A combination of historical and current data were utilized in evaluating the overall extent of existing contamination. The Cs-137 remaining from the individual isotope studies is the most significant radionuclide, with a concentration of 1.1 Bq/g (30 pCi/g) of soil. The Cs-137 that remains from the Sedan fallout is negligible when compared to this concentration. The other isotopes (from both the individual isotope studies and the Sedan fallout studies) are below current detection levels.

The amount and types of overall existing contamination indicates that a single clean-up level for Cs-137 will be developed and used in the verification process. Gross alpha and beta analyses will be performed to screen the verification samples to ensure that higher than expected concentrations of other isotopes are not encountered.

The extent of information available about the radionuclides introduced is adequate to complete remediation of the wastes, considering the following requirements:

- Soils from the surface to 0.6 m (2 ft) above grade will be removed, packaged for disposal, and sampled only to characterize the wastes for disposal.

Table C-2
Radionuclides From the Sedan Fallout

Radionuclide	January 1993 NTS Sample Results		Half-life	Equivalent Concentration in NTS Soil in 1962		Amount Introduced in 1962		Amount Remaining in 1993		Concentration in Soil	
	(Bq/g)	(pCi/g)	(Years)	(Bq/g)	(pCi/g)	(Bq)	(pCi)	(Bq)	(pCi)	(Bq/g)	(pCi/g)
Cesium-137	1.1	29	30.2	2.1	58	17×10^3	4.6×10^5	8.5×10^3	2.3×10^5	9×10^{-5}	2.5×10^{-3}
Americium-241	0.4	10	432	0.4	10	29×10^2	7.9×10^4	29×10^2	7.8×10^4	33×10^{-6}	9.0×10^{-4}
Cobalt-60	0.1	3	5.3	7.0	190	6×10^4	1.5×10^6	8.5×10^2	2.3×10^4	11×10^{-6}	3×10^{-4}
Plutonium-239	1.3	34	2.4×10^4	1.3	34	10×10^3	2.7×10^5	10×10^3	2.7×10^5	11×10^{-5}	2.9×10^{-3}

Explanation of Columns in Table C-2

January 1993 NTS Sample Results - The average concentration in Bq/g and pCi/g of each isotope that was found in analyzing two samples taken from near the Sedan Crater in late 1992.

Half-life - Period of time for one half of the radioactive activity to decay (in years).

Equivalent Concentration in NTS Soil in 1962 - The calculated concentration of the constituent when the soil was originally removed from the Nevada Test Site (NTS) in 1962. This concentration was calculated by adjusting the 1993 concentration with the decay that would have occurred over the last 30 years.

Amount Introduced in 1962 - The amount of each type of isotope that was introduced to the site during the 1962 radiological tracer studies. This was calculated by multiplying the concentration at the NTS by the 7,900 g (17.4 lb) of Sedan soil that eventually were disposed of in the mound (i.e., not including stream test).

Amount Remaining in 1993 - The amount of each type of isotope that was calculated to still exist after accounting for 30 years of decay.

Concentration in Soil - The concentration of each isotope that remains in the mound soil in 1993. Based on distributing the isotope homogeneously in 45 m^3 (1,600 ft^3) of soil in 1962.

- Soils above the 0.6-m (2-ft) level will be removed in 0.3-m (1-ft) increments (starting from the top of the mound) and set aside in discrete piles. Samples will be taken of these soils to verify that contamination does not exist above the clean-up level. Soils contaminated above the clean-up level will be packaged for disposal. Soils below the clean-up level will be utilized in backfilling the mound site.

- Following removal of the mound, the area below the mound will be sampled to verify that no contamination exceeding the remediation clean-up level has migrated into the soils below the mound. Any soils contaminated above the clean-up level will be removed and packaged for disposal. Additional verification samples and removal efforts will continue in any identified contaminated areas until no contamination above the clean-up level is detected.

C.3.0 Exposure Assessment

An assessment of exposure to a population must consider the setting in which the exposure takes place and potential pathways for exposure. These factors can then be utilized to quantify the potential types of exposure to humans.

C.3.1 Characterization of Exposure Setting

Characterizing the exposure setting involves determining the physical characteristics of the site as well as those of the human populations on and near the site.

C.3.1.1 Physical Setting

The physical setting of the overall Ogotoruk Valley (including the area of the mound site) is extensively discussed in *Environment of the Cape Thompson Region, Alaska,* Books I and II, 1966. Specific areas of interest for identifying transport methods are:

- *General Environment* - Tundra environment with relatively flat profile covered with grass hummocks, mosses, lichens, and low shrubs.

- *Precipitation* - The climate of northwestern Alaska is classified as semimaritime. Excessive amounts of precipitation typical of a maritime climate do not occur due to the temperature and storm patterns. Annual precipitation in the Ogotoruk Valley is estimated at 28 centimeters (cm) (11 inches [in.]) per year. Approximately 80 percent of the precipitation occurs from June to September.

- *Wind* - A noticeable feature of northwestern Alaska is the high-velocity surface winds. Annual average wind speeds are in the 15 to 20 knots (17 to 23 miles per hour [mph]) range in the Ogotoruk Valley. The wind is not a significant factor for distribution of the contamination, however, due to the overburden present covering the contaminated soils.

- *Soils* - The soils in the area of the mound are poorly drained and contain significant organic buildup, as shown by the extreme black color on visual inspections (at the time of covering). The peaty types of soils that cover most of the surface of the Ogotoruk Valley have low thermal conductivity (Chapter 2). This leads to a frozen zone (i.e., permafrost) in the valley that varies from within 20 cm (8 in.) to 1 m (3 ft) of the ground surface (Chapter 13). This frozen barrier and the limited precipitation in the area minimizes the potential for migration of contaminants out of the mound either downward (to contaminate lower soil reaches) or radially (where it could reach plant roots or the soil surface).

- *Vegetation* - The vegetation present (Chapter 14) is relatively shallow rooted due to winter conditions and the nature of the permafrost in the region. The types of vegetation present include hummocks, mosses, lichens, and some low shrubs. These types of plants present minimal concern over uptake due to the cover of dirt on the mound. The actual mound of contaminated dirt is of a relatively small size (12 by 12 m and 0.46 m high [40 by 40 ft and 1.5 ft high]) when compared to the overall mound (12 by 12 m and 1.5 to 2 m high [40 by 40 ft and 5 to 6 ft high]). This gives a minimum of 0.6 to 1 m (2 to 3 ft) of overburden through which roots must grow before reaching contaminated dirt. Samples of the soil in the overburden taken in September 1992 exhibited normally appearing background radionuclides and no contamination for the major chemical of concern (Cs-137).

- *Surface Waters* - Surface waters in the valley originate from precipitation and melting of snow and ice. There is little or no flow in Ogotoruk Creek or its tributaries during the months from November to April. High flows result only from melting of snow and ice and from rainstorms lasting more than 12 hours. Due to the shallow permafrost, most precipitation does not infiltrate deep into the ground. In fact, many peak runoff rates for the faster flows approach the rate of precipitation.

- *Groundwater* - Geologic investigations indicate that except for the stream floodplain and terraces, only a thin mantle of weathered material overlies the bedrock. Perennially frozen ground prevents shallow aquifers from occurring in this mantle. The potential for contamination of groundwater from the mound is limited due to the permafrost zone and the limited groundwater capacities in the Ogotoruk Valley.

C.3.1.2 Potentially Exposed Populations

A human geographical study was also performed as part of the original Project Chariot. Although dated in its census of the population, the basic population groups, activity patterns, and the uses of land have not changed considerably.

- *Affected Populations* - The main populations that could be affected by the site include the villagers of Point Hope and Kivalina. Point Hope lies approximately 40 kilometers [km] (25 miles [mi]) to the northwest, while Kivalina is located approximately 72 km (45 mi) to the southeast.

- *Current Land Use* - The mound itself is located in a national wildlife refuge. A native allotment exists near the mound site, with some abandoned buildings and structures from previous studies. The major utilization of the land that could affect humans are subsistence hunting in the valley or those transiting the valley. Hunting activities in the direct area include caribou, fishing, and egg gathering.

- *Future Land Use* - In the future, native allotments may be parcelled out within the valley. A native allotment also exists near the site, and the future utilization of the land is continued hunting and transit type activities. There is some potential for additional activity if some form of camp is established in or near the existing buildings.

- *Overall Exposed Populations Conclusions* - The amount of time spent in the region by an individual is limited due to the distant nature from the villages (Point Hope - 40 km [25 mi] and Kivalina - 72 km [45 mi]). The model for an individual will utilize a 10 percent occupancy rate based on the distance from the site and the limited nature of people entering the area. This is a conservative estimate due to the fact that:

    - no significant lodging capabilities exist in the area

    - the inhospitable climate during the winter months limits the travel in the area for a significant portion of the year

    - the extent of contamination is very small.

C.3.2 Identification of Exposure Pathways

Contaminated soil at all sites present the possibility of a direct route of exposure to humans and biota through incidental ingestion, dermal contact, and direct radiation. Secondary routes of exposure may also occur due to uptake by plants, resuspension of dust, vapor transfer into the air, and surface and groundwater contamination. Both flora and fauna can incorporate contaminants from soil and provide a route of exposure to humans through ingestion.

The primary exposure routes for humans are the most likely pathways for exposure to the general population in this situation. The cover of soil over the radioactive tracer materials minimizes the potential for direct exposure to humans through dermal contact and incidental ingestion. The amount of direct radiation exposure is negligible due to the mound cover. Recent surveys of the area indicate that no radiation levels are above background levels with the soil cover in place. These exposure mechanisms could become more important, however, if the mound cover were removed or disturbed. For these reasons, direct exposure and incidental ingestion will be the primary exposure mechanisms that are used in the exposure modeling.

The soil cover and the climate of the region minimize the concern for secondary exposure. The soil cover that exists at the mound acts to eliminate the possibility of resuspension of contamination in dust or vapor transfer into the air. The climate in the area, in particular the freezing zone (permafrost), minimizes the potential for contamination migration below the mound, groundwater contamination, and surface water contamination. The limited possibility of contamination spreading from these latter mechanisms, however, will be confirmed in the verification sampling program associated with the project.

The source and quantity of radioactive material introduced to this particular site is well known and of a one-time nature. Based on this fact, there are no known pathways for additional radiological contaminants to enter the site.

C.3.3 Human Exposure Modeling

A conceptual model for human exposure to the original tracer studies soils has been established. The model consists of the original soils mounded together, but prior to covering with fill material. This is a hypothetical model that will be utilized for human modeling only. It was chosen to remove the soil cover because this ensured that the exposures calculated would be greater than those actually received with the current conditions.

Pathways of potential radiological risks to humans with this model were identified as direct ingestion and external radiation exposure.

The pathway of uptake by plants is not considered because it is a secondary mechanism for the direct ingestion route. By removing the soil cover (in the hypothetical model), this route has been replaced with direct ingestion of the soil.

C.4.0 Risk Characterization

An evaluation of the existing risk is an essential part of the overall clean-up effort. The level of existing risk can then be factored into determining the remediation clean-up level.

C.4.1 Standardized Exposure Models

Risk levels associated with radionuclide contamination can be characterized using EPA's Health Effects Assessment Summary Tables (HEAST). The HEAST tables present the various carcinogenic risk factors for individual radionuclides. These factors are combined with the setting of the exposure (e.g., duration, contamination level, and depth of contamination) and an overall risk of cancer is estimated. Alternately, a risk can be established and then a remediation clean-up level can be calculated that will correspond to that risk.

The equation for risk of carcinogenic effects for residential soils is presented in "Development of Risk-based Preliminary Remediation Goals," *Human Health Evaluation Manual, Part B*, EPA, 1991. Equation 11 is stated as:

$$\text{Total Risk} = RS * [\text{Ingestion Risk} + \text{External Exposure Risk}]$$
$$= RS * [(SF_0 * 10^{-3} * EF * IF_{soil}) + (SF_e * 10^3 * ED * D * SD * (1-S_e) * T_e)]$$

RS	Radionuclide contamination level in soil (pCi/g)
SF_o	Oral (ingestion) slope factor (risk/pCi)
EF	Exposure frequency (days/year)
IF_{soil}	Age-adjusted soil ingestion factor (mg-year/day)
SF_e	External exposure slope factor (risk/year per pCi/m^2)
ED	Exposure duration (yr)
D	Depth of radionuclides in soil (m)
SD	Soil density (kg/m^3)
$1-S_e$	Gamma shielding factor (unitless)
T_e	Gamma exposure time factor (unitless)

This equation is based on external exposure slope factors being presented in risk/year per pCi/m^2. Recent revisions to the HEAST slope factors, however, have changed the units of external exposure to risk/year per pCi/g of soil. This changes the external exposure portion of the equation to:

External Exposure Risk = $(SF_e*ED*(1-S_e)*T_e)$

The overall equation that will be utilized in this risk characterization is:

Total Risk = RS * $[(SF_0*10^{-3}*EF*IF_{soil}) + (SF_e*ED*(1-S_e)*T_e)]$

C.4.2 Existing Contamination Risk Calculations

A calculation of the total risk from exposure to the radioactive materials currently at the site was performed. The scenario that was utilized in the risk analysis involved the following assumptions:

Contamination level - Cs-137 was present in the tracer study soils and distributed homogeneously at a concentration of 1.1 Bq/g (30 pCi/g) as calculated earlier in Section 2.0).

Shielding - No shielding was assumed to exist for the purposes of the calculations. The dirt cover was removed and only the actual 45 m^3 (1,600 ft^3) of tracer study soils remained.

Human Occupancy - Humans were limited to being in the area for only 10 percent of the year due to the remote nature of the site.

The overall current risk was then established as:

Total Risk = RS * $[(SF_0*10^{-3}*EF*IF_{soil}) + (SF_e*ED*(1-S_e)*T_e)]$

RS	30 pCi/g
SF_o	2.8×10^{-11} risk/pCi
EF	40 days/year
IF_{soil}	3600 mg-year/day
SF_e	2.0×10^{-6} risk/year per pCi/g of soil
ED	30 years
$1-S_e$	1 (unitless)
T_e	0.1 (unitless)

The results of the analysis indicates that a risk of 2×10^{-4} over a person's lifetime currently exists if the soils were to be left in place without the soil cover and the person spent 40 full days per year on the mound of contaminated soil. This exposure is over 99 percent due to external exposure, with minimal exposure coming from soil ingestion.

C.4.3 Preliminary Remediation Goal

A preliminary remediation goal for Cs-137 was then calculated utilizing the same techniques. This preliminary remediation goal is the first step towards identifying the remediation clean-up level.

The equation used in the current risk calculation was rearranged to use an acceptable Total Risk and calculate the corresponding contamination level (RS).

$$PRG\ (RS) = \frac{\text{Total Risk}}{[(SF_0 * 10^{-3} * EF * IF_{soil}) + (SF_e * ED * (1-S_e) * T_e)]}$$

PRG	Preliminary remediation goal (pCi/g of soil)
Total Risk	1×10^{-4} risk of cancer over a lifetime
SF_o	2.8×10^{-11} risk/pCi
EF	40 days/year
IF_{soil}	3600 mg-year/day
SF_e	2.0×10^{-6} risk/year per pCi/g of soil
ED	30 years
$1-S_e$	1 (unitless)
T_e	0.1 (unitless)

The results of this calculation were a preliminary remediation goal of approximately 0.7 Bq/g (20 pCi/g) of soil.

C.5.0 Site Modeling

Modeling of the site conditions was necessary to estimate the exposure to radiation that a member of the general population would receive. The modeling was performed using the RESRAD computer code and the following assumptions:

- The soil cover was removed
- 10 percent of an individual's year was spent at the mound
- Cs-137 was homogeneously distributed in the soil at a concentration of 0.4 Bq/g (10 pCi/g) of soil.

The results of the modeling indicate that a person who resided on top of the mound (after the fill cover was removed) for 10 percent of the year would receive an additional 3 millirems per year (mrem/yr) of exposure above background. These results are significantly below the DOE limits for exposure to the general public of 100 mrem/yr. The principles of ALARA are also incorporated into the 0.4 Bq/g (10 pCi/g) concentration, in that it is 50 percent of the concentration that would be allowed under the EPA's guidance for contamination at Superfund Sites.

C.6.0 Clean-Up Level

The DOE guidance for exposure to the general public requires that exposure be limited to 100 mrem/yr, but should be reduced as much as possible in accordance with the ALARA principle. A remedial clean-up level of 0.4 Bq/g (10 pCi/g) for Cs-137 was identified for this remediation effort. This remediation clean-up level is based upon reducing exposure to the public and represents an exposure to a member of the general public of approximately 3 mrem/yr. This exposure level is well below the required 100 mrem/yr level and incorporates the principles of ALARA.

The exposure-based remedial clean-up level of 0.4 Bq/g (10 pCi/g) was verified to ensure that it was comparable with EPA's guidance for evaluating human health. Calculations of acceptable preliminary remediation goals for a 1×10^{-4} risk of cancer over a lifetime indicated that a concentration of 0.7 Bq/g (20 pCi/g) was acceptable. The chosen remedial clean-up level is one half of the acceptable level calculated in accordance with EPA guidelines.

APPENDIX D

SPILL PREVENTION CONTROL AND COUNTERMEASURE PLAN

This page intentionally left blank

Spill Prevention Control and Countermeasure Plan

Taiga Ventures
2700 S. Cushman
Fairbanks, AK 99701
907-452-6631

Contact
Mike Tolbert, Owner

Certification
Engineer: James Ringstad

Signature:

License Number: C.E. 4623

State: Alaska
Date: June 10, 1993

STATE OF ALASKA
49TH
James R. Ringstad
C. E. 4623
REGISTERED PROFESSIONAL ENGINEER

1. Name and Ownership

Taiga Ventures
Owner and Manager: Mike Tolbert
2700 S. Cushman
Fairbanks, AK 99701
907-452-6631

2. Description of the Facility

The Chariot camp will support the clean-up efforts of people employed by DOE for the removal of low-level radioactive contaminated soil. Fuel used at the camp will include: diesel, motor gas, heating fuel and aviation gas. The accompaning drawing shows the proposed facility layout.

Fixed Storage:

(1) 10,000 gallon diesel fuel bladders with containment
(1) 3,000 gallon motorgas fuel bladder with containment
(1) 1,000 gallon av-gas fuel bladder with containment
(12) 55 gallon drums for heating oil

Vehicles:

(8) 4-wheelers
(1) bobcat with bucket
The camp will be surrounded by a barbed wire fence with a locking gate and patrolled by an armed security guard 24 hours per day.

3. Past spill experience

(None)

4. Spill Prevention-Storage Tanks

Each bladder will be "diapered" with an impervious liner and absorbent material and placed in a self-supporting containment area which is capable of storing at least 115 percent of the capacity of the bladder. The generator units which will be used at the shelter equipped work site and main camp also will be diapered and diked. Diapers and dikes will be constructed in workmanlike manner onshore.

Fuel used to heat the tents at the base camp and the shelters at the work site will be stored in 55 gallon drums. Each drum will be placed inside a poly containment capable of handling 200 percent of the drum's capability. In addition, the containment will contain absorbent materials.

5. Fire Suppression

The following fire suppression equipment and spill tools will be on site at the fuel staging base.

* 10 - Heavy-duty coal shovels
* 10 - Picks (Pulaski type)
* 10 - Rakes
* 10 - Dirt shovels
* 10 - Rolls absorbent
* 10 - 5 pound CO_2 extinguishers
* Lot - absorbent pads

This equipment will be positioned so that it can be deployed rapidly and efficiently.

6. Inspection

All staging base installations will be inspected daily, and the results will be logged. Fuel storage sites will be under 24-hour surveillance with formal inspections and the logging of results occurring every 12 hours. Inspection records will be maintained by the Camp Manager on the crew. Inspections will include checks of all valves, bladders, diapers, dikes, fuel lines and hoses. In addition, the emergency response equipment will be examined, as will the surrounding area for signs of a spill. Also, the inspectors will insure that all appropriate warning signs are properly exhibited . Any hazardous condition in and around fuel storage locations will be corrected immediately.

Fuel storage areas, fuel lines, generator units, refueling areas, stoves and other equipment and supplies at the work site shelter will be inspected twice daily and the results logged.

Supervisors and staff members working in or around base camp will be responsible for surveillance and inspection of equipment and supplies and elimination of hazardous conditions throughout the camp compound. Inspection logs will be kept by the camp manager and IT project manager.

7. Spill Cleanup

Project personnel will have sufficient cleanup equipment available to contain and cleanup the maximum potential spill. At all times, the quantity of cleanup equipment will comply with the requirements of the NSB Special Use Permit and all other applicable federal, state and local laws, regulations and permits. In the event of a spill:

* The highest priority will be accorded to human safety, and all decisions made and actions taken will be consistent with this priority.

* The source of the spill will be determined and the flow stopped as soon as possible.

* The spill should be contained within the diked area. If not, secondary dikes will be constructed or other appropriate measures will be employed to halt the spread of the substance spilled. Taiga will have a Bobcat machine with bucket in the camp area and parked at the fuel storage area when not in use in the compound.

* Once the fuel or other substance is contained, cleanup and spill site restoration efforts will be initiated. Cleanup efforts will include the spreading of absorbent materials on the substance spilled. The absorbent materials will be turned and replaced to maximize the

efficiency of the cleanup effort. Once the standing fuel or other substance is removed, all contaminated materials, will be transported to an approved disposal site, as required. Any fuel, or other hazardous substance remaining in a ruptured container will be pumped into another appropriate storage vessel.

* The spill will be reported, using the following procedures:
--The person detecting the spill will contact his/her immediate supervisor
--This supervisor will obtain all facts and report immediately to Taiga's field supervisor and the IT Corp. project manager.
--Taiga's field supervisor and the project manager will initiate the containment, cleanup and site restoration procedures and notify Taiga's Fairbanks office.
--The Fairbanks office will notify the Alaska Department of Environmental Conservation's daytime phone (1-9070451-2360) or 24-hour (1-800-478-9300) line, the EPA response line (1-907-271-5083) or (1-800-424-8802). These EPA numbers will alert the Coast Guard as well. Taiga's Fairbanks office will prepare and submit the written oil spill report (sample attached). Copies of the report will be transmitted to all concerned parties.
--Taiga's Fairbanks office will be available to provide further liaison with governmental agencies regarding containment, cleanup and restoration operations and to oversee the orderly resolution of the spill.

Mike Tolbert

HAZARDOUS SUBSTANCE SPILL REPORT FORM

1. Date and Time of Spill or First Observation:

   ____

2. Report Date: ______________________________

3. Spill Location (be specific as to map coordinates, location name, location description, etc.):

   ____
   ____
   ____

4. Spill Description, including movement of the substance: __________

   ____
   ____
   ____

5. Estimate of Spill Volume: ______________________________

6. Storage Capacity of Container: ______________________________

7. Substance Description: ______________________________

8. Environmental Summary:
   a. Ground Conditions: ______________________________

   b. Water Conditions (if applicable):

      ____

   c. Temperature, Wind Direction and Speed:

      ____

   d. Visibility, Ice and Snow Conditions and Depth, etc.:

      ____

9. Potential Areas of Contamination (discuss terrain and probable flow, beaches, water bodies, wildlife areas, etc.):

   ____
   ____
   ____
   ____

10. Cause of Spill:

____
____
____
____

11. Containment and Cleanup Action Taken:

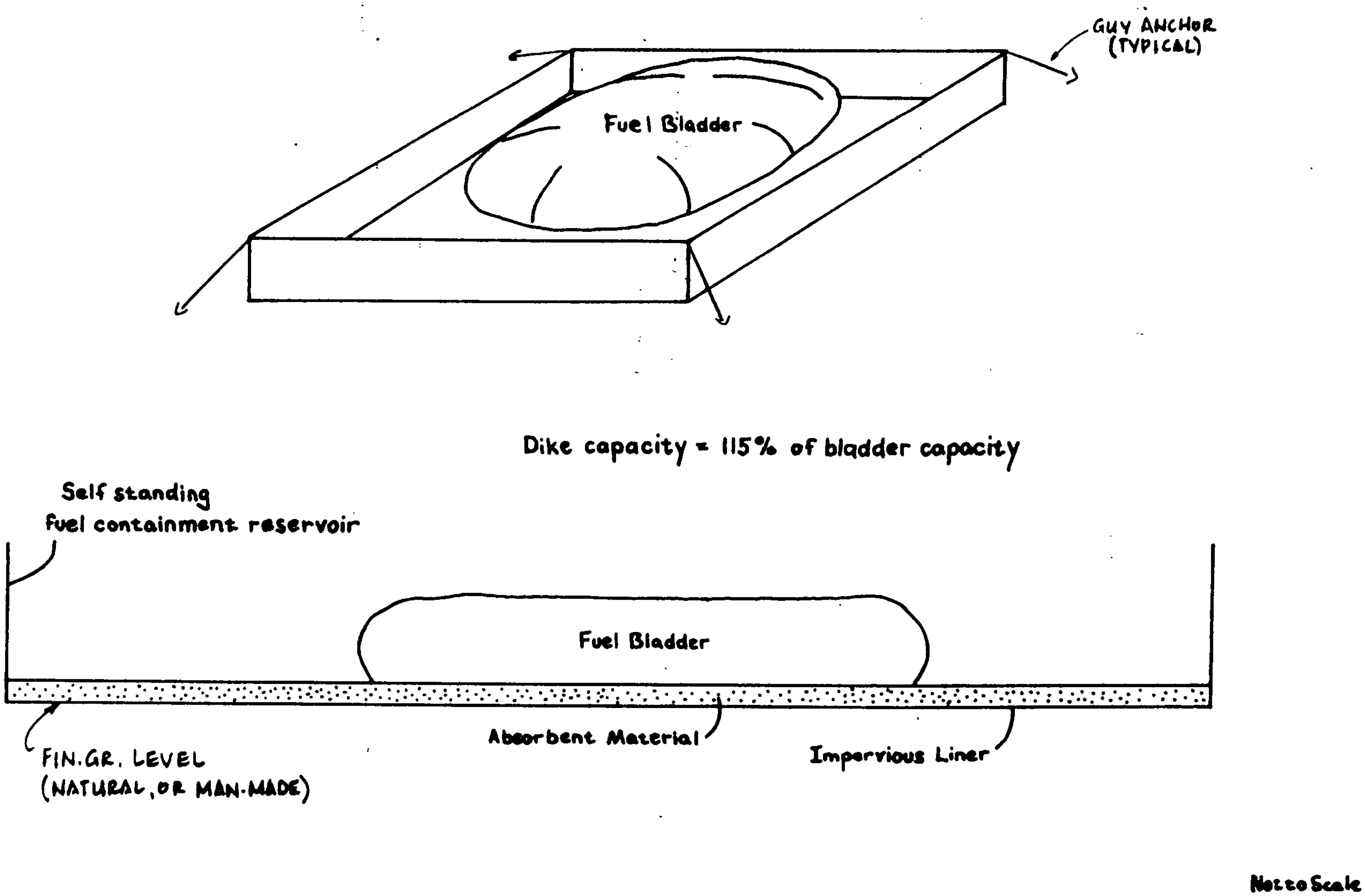
____
____
____
____

12. Individuals and Agencies Notified of Spill:

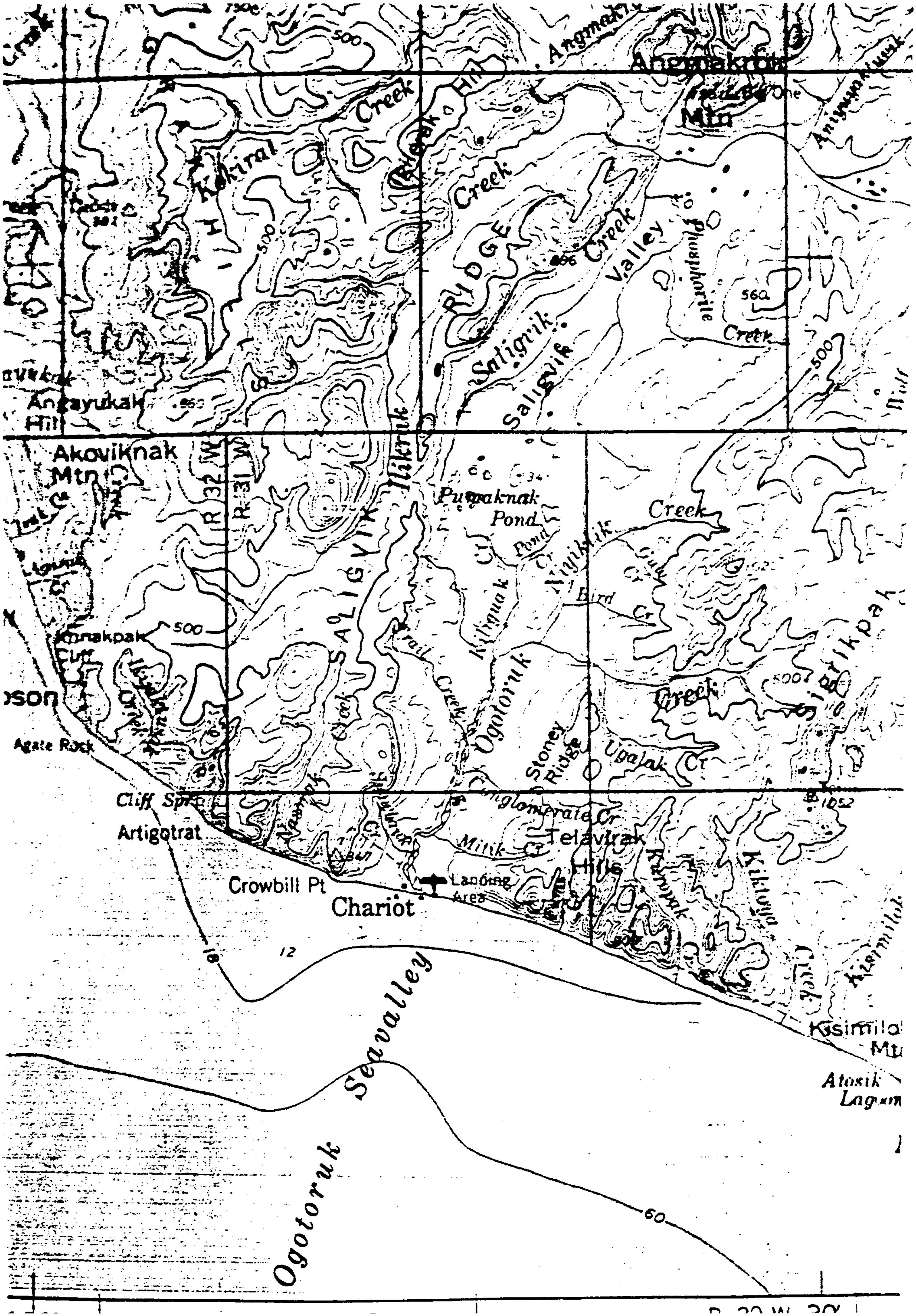
Name	Date/Time

Prepared By:

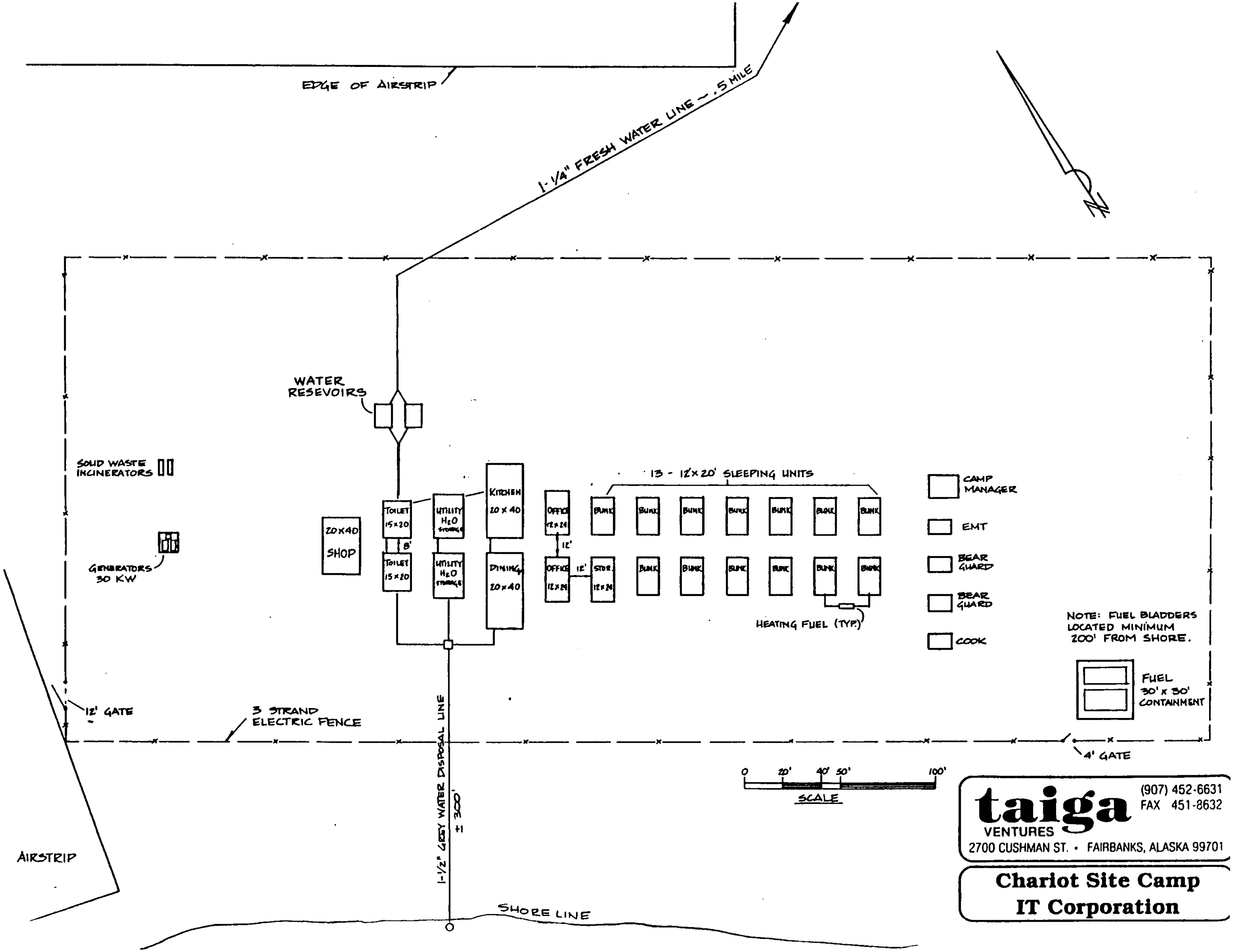
Signature:______________________________
Print Name:______________________________
Title:______________________________



Fuel Storage Areas
(TYPICAL)



Creek
RIDGE
Creek
Valley
Phosphorite
Creek
500
Angayukak
Hill
Akoviknak
Mtn
R 32 W
R 31 W
SALIGVIK
Pond
Creek
Bird
Cr
Ogotoruk
Stoney
Ridge
Creek
Ugalak Cr
500
Agate Rock
Cliff Spr
Artigotrat
Conglomerate Cr
Telavirak
Hills
Crowbill Pt
Landing
Area
Chariot
12
Ogotoruk Seavalley
60



Chariot Site Camp
IT Corporation

This page intentionally left blank

APPENDIX E

UNI-MAT SPECIFICATIONS

This page intentionally left blank

UNI-MAT™

Uni-Mat Uses In The Construction Field

- Stable, safe road systems that support heavy haul loads and continuous traffic flow of machinery, equipment and personnel.
- Inventory control areas and protection of equipment, material and rolling stock from weather, soil and elements.
- Portable stable foundation areas for portable buildings, job shops and storage areas.
- Removable support foundation areas for heavy lift equipment (cranes, cherry pickers, manlifts, etc.).
- Walkways, parking areas and foundation areas for portable offices, hygiene areas and temporary assembly areas.
- Giant pallet application for movement of components or equipment to assembly areas.
- Storage points with built in dunnage contact points.
- Shoring for earth works.
- Protective support for crossing subterrain items such as pipelines, water mains, culverts, cables, etc.
- Bridge or critical low load - crossing spreaders that promote even distribution of heavy loads to main column supports, pillars or piles.

Advantages of Uni-Mat System Over Other Methods

- Patented, prefabricated mats greatly reduce installation and removal time. Minimal labor requirements help reduce costs and significantly reduce accident exposure.
- Uni-Mats interlock and lay in pattern that disperses weight of heavy loads.
- 1.5 ply design reduces weight of individual Uni-Mats making them easier to handle than old style mats.
- Versatility of Uni-Mats simplifies layout patterns.
- 8' x 14' (2.44 m x 4.27 m) mats permit easy shipment by truck, rail, barge or ship. Orderly stacking arrangement eases loading and off loading.
- Permatizing option is simple and cost effective.
- Provides a smooth, even and stable road or work surface eliminating the need to follow board tracks or the hazardous and equipment damaging shifting, sinking and tipping inherent with old style mats.

UNI-MAT™

System Specifications

	SAE	METRIC
Dimensions	8' x 14' x 4" (112 ft²)	2.44 x 4.27 x 100 mm (10.42 m)
Weight	Approx. 1400 lbs	Approx. 635 kg
Lumber	12 ea. 2" x 7" x 14' 10 ea. 2" x 7" x 8'	12 ea. 50 mm x 175 mm x 4.27 m 10ea. 50 mm x 175 mm x 2.44 m

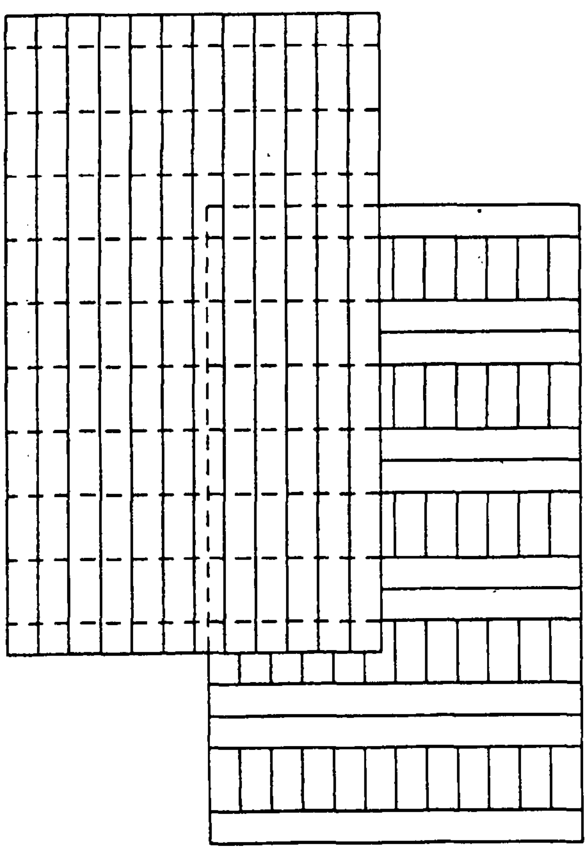
Engineering Data:
Oak Lumber or Comparable

Compression

	Prop Limit	Ultimate Strength	Modulus of Elasticity	Modulus of Rupture	Parallel to Grain Max. Crushing Strength	Perpendicular to Grain Fiber Stress and Prop Limit
SAE (psi)	4300	7100	1.6 x 106	15,200	7440	1070
Metric (N/mm²)	29.6	49	11,034	104.8	51.3	7.4

These values are suggested based on a reasonable safety factor and may vary with geographical source, seasoning, water content, etc.

Uni-Mat Layout Diagram



Patent Numbers

Mat – #4,899,444

Assembly Device – #4,922,598

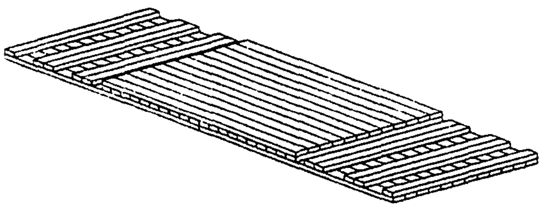
Trade Mark – #1,594,242

Uni-Mat holds 40 domestic and international patents and patents pending.

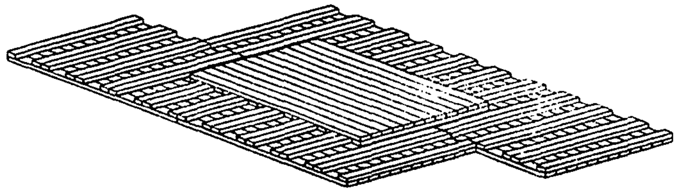
UNI-MAT

Illustration of Uni-Mat Interlocking Patterns and Mat Requirement Equations

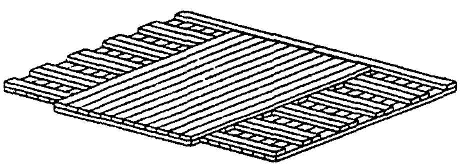
The following diagrams illustrate various interlocking patterns that are expandable for specific area requirements by continuing the pattern throughout. If, for example, pattern No. 4 (below) is chosen for a twelve foot wide road, one would add mats to the end in the same pattern until the desired length is attained. Should a twenty-four foot wide road be required pattern No. 6 would be modified to two full mats (inside bottom) and two 1/2 mats (outside bottom) and three full mats on top, always maintaining the staggered pattern as illustrated. Should a larger area be required (ie., construction sites, drilling locations, etc.) pattern No. 6 would be expanded for the length and breadth of the area. Mat dimensions are 8' x 14' = 2.44 m x 4.27 m on full mats and 4' x 14' = 1.27 m x 4.27 m on half mats. In the equations for computing mat requirements, UMR indicates **Uni-Mat** requirement and L = length of road. In computing **Uni-Mat** requirements for larger areas the equation is (L x width ÷ 112) x 2 or (L x width ÷ 10.46 m^2) x 2.



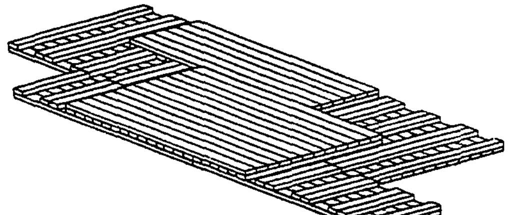
1. Eight foot wide roadway with 8' base. **Uni-Mat** requirement equation is UMR = (L ÷ 14) x 2 or (L ÷ 4.27 m) x 2



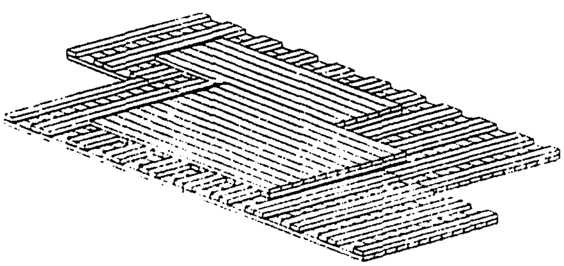
2. Eight foot wide roadway with 16' base for maximum weight displacement. UMR = (L ÷ 14) x 3 or (L ÷ 4.27 m) x 3



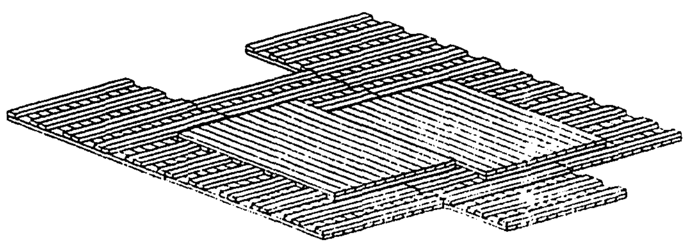
3. 12' 10" wide horizontal pattern with 14' base. UMR = (L ÷ 8) x 2 or (L ÷ 2.44 m) x 2



4. 12' wide with 12' base utilizing 1/2 mats top and bottom. UMR = (L ÷ 14) x 3 or (L ÷ 4.27 m) x 3



12' wide with 16' base utilizing 1/2 mats top (for additional weight displacement). UMR = (L ÷ 14) x 3.5 or (L ÷ 4.27 m) x 3.5



16' wide with 24' base (Maximum weight displacement). UMR = (L ÷ 14) x 5 or (L ÷ 4.27 m) x 5

UNI-MAT™

Now Let's Talk About
SAFETY

Prevention of costly and possibly tragic lost time accidents to personnel and equipment is a topic of monumental importance we feel should be emphasized to our customers.

The concept of a prefabricated interlocking, weight disbursing mat system as patented by **Uni-Mat** was developed with safety as the primary consideration.

We urge you to strongly consider the following safety factors when choosing a temporary road or mat system for your next project.

- *Does the system you are considering interlock to prevent hazardous shifting and tipping of the work surface?*

  Unlike old style crane or laminated mats **Uni-Mat**'s system interlocks to provide a safe and stable surface.

- *Is installing the system labor intensive thereby multiplying the exposure to injury?*

  Unlike old style board roads that require extensive man hours dedicated to unloading, stacking, handling, assembling, maintaining, tearing down, restacking and hauling away lumber and nails, the **Uni-Mat** system requires only two laborers and a forklift operator for the average project.

- *Will the system tolerate heavy loads over soft or marshy terrain without the danger of excessive settling or sinking?*

  Uni-Mat's patented interlocking and weight disbursing concept eliminates common seams, provides a work area that is consistently stable on low ground pressure areas, and is maintenance free.

- *Will the work site be free of nails, boards or other hazardous debris when the system is dismantled and removed?*

  With **Uni-Mat** the prefabricated units are removed quickly and completely. No piles of loose boards with protruding or loose nails to invite accidents.

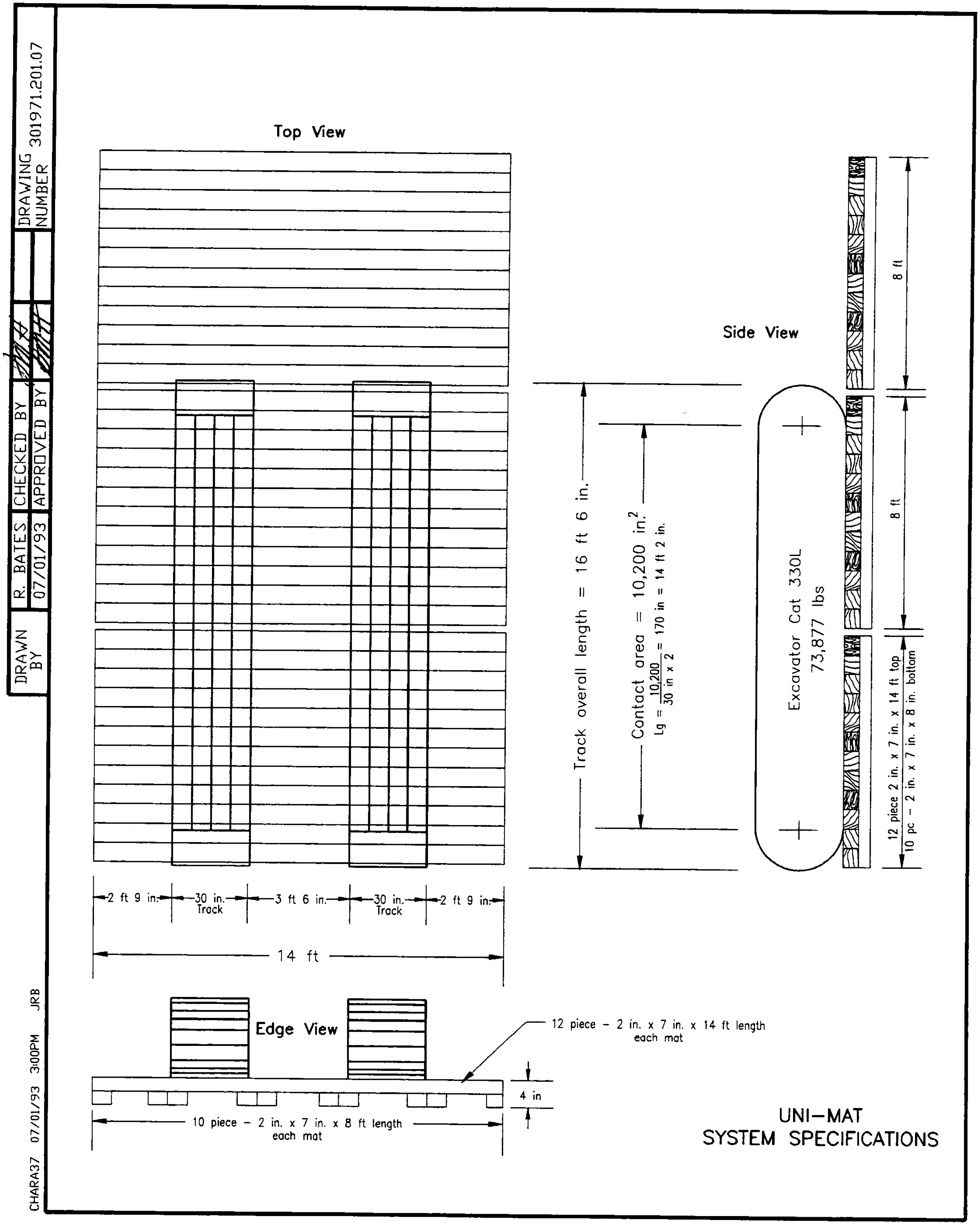
- *Is there a danger of injury as a result of tripping over exposed cable loops or lifting bolts?*

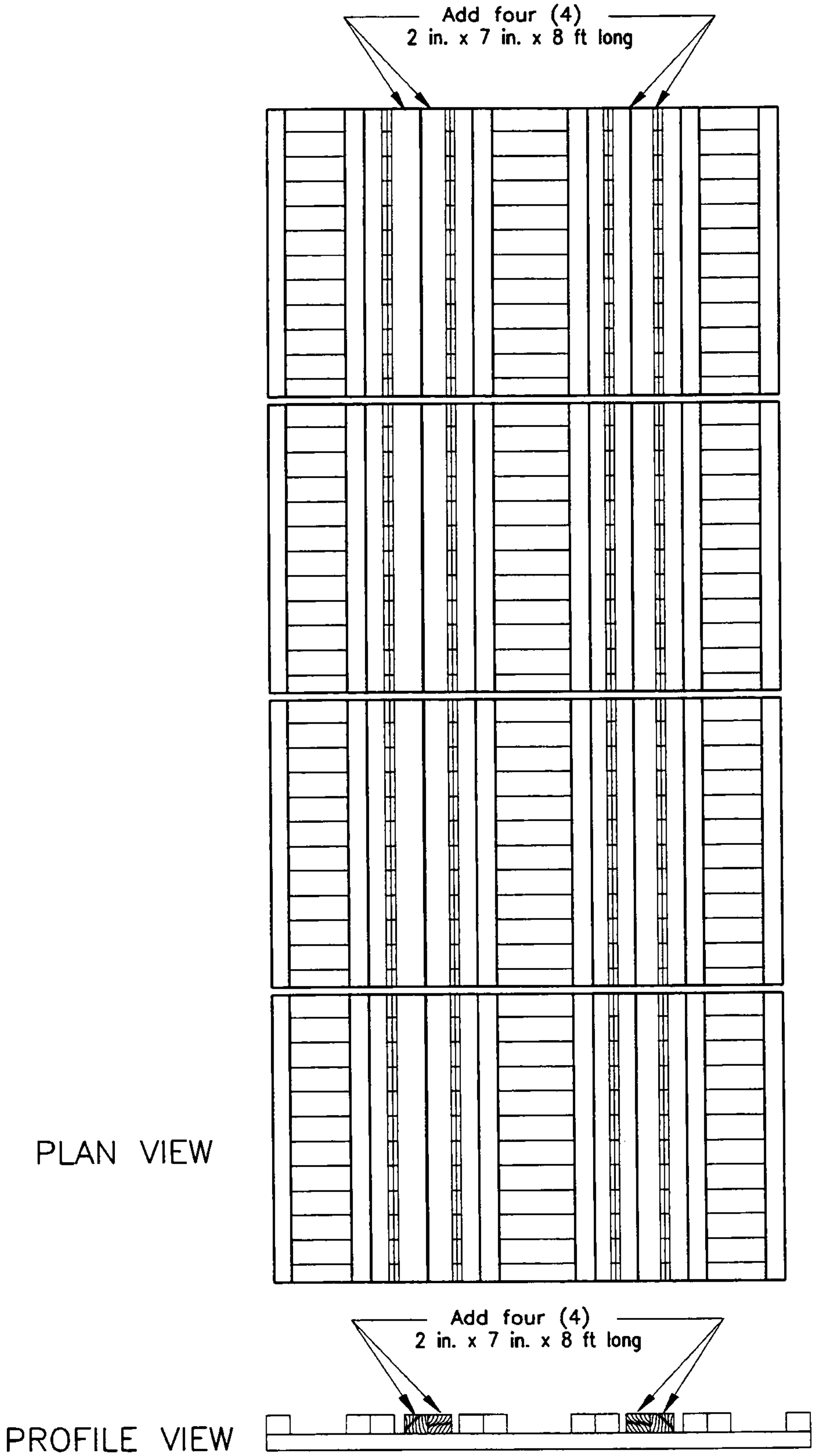
  The **Uni-Mat** system has eliminated these accidents waiting to happen.

- *Will the system you are considering help protect underground installations?*

  The load dispersion feature unique to the **Uni-Mat** system helps prevent concentrated loads when crossing sensitive underground installations such as pipelines, water mains and tunnels.

To Be Safe Specify **Uni-Mat.**


DRAWING NUMBER 301971.201.07
R. BATES
CHECKED BY
07/01/93
APPROVED BY
DRAWN BY
Top View
Side View
Track overall length = 16 ft 6 in.
Contact area = 10,200 in.^{2}
$Lg = \frac{10,200}{30 \text{ in} \times 2} = 170 \text{ in} = 14 \text{ ft } 2 \text{ in.}$
Excavator Cat 330L
73,877 lbs
8 ft
8 ft
12 piece 2 in. x 7 in. x 14 ft top
10 pc - 2 in. x 7 in. x 8 in. bottom
2 ft 9 in.
30 in. Track
3 ft 6 in.
30 in. Track
2 ft 9 in.
14 ft
Edge View
12 piece - 2 in. x 7 in. x 14 ft length each mat
4 in
10 piece - 2 in. x 7 in. x 8 ft length each mat
UNI-MAT
SYSTEM SPECIFICATIONS
CHARA37 07/01/93 3:00PM JRB



UNI-MAT
SUPPORT SYSTEM

DRAWN BY	R. BATES 07/01/93
CHECKED BY	
APPROVED BY	
DRAWING NUMBER	301971.201.07

CHARA36 07/01/93 3:00PM JRB

APPENDIX F

OVERSIZE FIGURES P1 THROUGH P-7

Appendix F is not available in electronic format.